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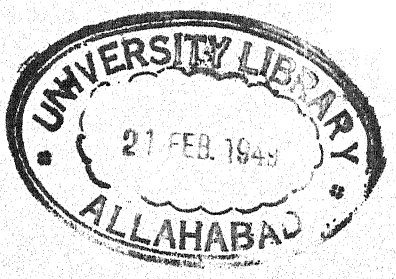
HEPATICAE OF NORTH AMERICA

T. C. FRYE and LOIS CLARK



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(Accompanying this book is a mimeographed bibliography applying to this portion of the volume.)

FOREWORD

A large bibliography has slowly accumulated in the preparation of this work. The citations are in alphabetical order and are referred to by numbers in parentheses, chiefly in the statements of range and the lists of illustrations. It was found impractical to give all the references to range, so only one is given for each state or country; and it is not always the chief one which is given. When ranges were cited in literature as from one state to another, the intervening states were not included because the occurrence was too uncertain. It is almost impossible to keep errors out of these references by numbers; the bibliography will be found at the close of the volume.

Space likewise limits the printing of citations of examinations. We have endeavored to keep this within six printed lines.

Since some of the references to illustrations are used so often, they have been very much abbreviated. The number in parentheses refers to the bibliography. These references are as follows: Gil (76) is Casares-Gil Fl. Iberica,—Hepaticas, 1919, Madrid. Macvicar (374) is Macvicar Student's Handbook of Brit. Hep., Ed. 2, 1926. Meylan (386) is Meylan Hep. Suisse, 1924. K. Mueller (409) is K. Mueller, Die Lebermoose, Rabenhorst's Krypt.-Fl. Deutschl. Oesterreich und der Schweiz, Ed. 1, 6 (1-2): 1907-1916. Pearson (433) is Pearson Hep. Brit. Isles, 2 vols., 1902. Schiffner (458) is Schiffner, Hepaticae, Engler & Prantl's Nat. Pflanz.-Fam., Ed. 1, 1(3)1: 1-141, 1893. Warnstorf (523) is Warnstorf Krypt.-Fl. Mark Brandenburg 1: 1902-1903. Clark & Frye (81) is Clark & Frye, Liverworts of the Northwest, Publications of the Puget Sound Biological Station 6:1-194, 1928.

This part carries the work only to the leafy liverworts. The bibliography and index will be included in the second part of the volume. For the sake of our foreign readers a list of abbreviations will also be included.

T. C. Frye and Lois Clark

January, 1937.

Hepaticae of North America

BY
T. C. FRYE AND LOIS CLARK

HEPATICAE[1]

Gametophyte thalloid or more often leafy, usually dorsiventral, apical in growth. Rhizoids nearly always present, without transverse walls. Leaves when present nearly always complanate, in 2 or 3 rows in almost all leafy species, without a distinct midvein, their cells isodiametric or not greatly elongated. Protonema rudimentary or none. Sex organs either superficial or terminal in origin, terminating the growth if terminal. Sporophyte consisting of a single sporangium with or rarely without a stalk. Sporangium without a well-formed lid, without peristome, usually opening by valves, without columella except Anthocerotales. Elaters among the spores except in the lowest few genera.

Gametophyte thalloid or leafy, with numerous chloroplasts per cell in the green region; sporangium spherical or oval, opening without valves or by more than 2, without columella, without stomates.
  Gametophyte thalloid, mostly with air chambers or pores, with a sharp distinction between photosynthetic and ventral tissue; in nearly all species some of the rhizoids with peg-like interior thickenings of the walls..... *Marchantiales*, p. 7
  Gametophyte thalloid or leafy, even the thalloid ones without air chambers or pores, without a sharp distinction in thalloid species between photosynthetic and ventral tissue; all rhizoids with smooth walls..... *Jungermanniales*, p.103
Gametophyte thalloid, with 1 or rarely 2 chloroplasts per cell in the green region; sporangium cylindrical or filamentous, spliting into 2 valves, with columella, with stomates; all rhizoids with smooth walls..... *Anthocerotales*, p. ....

MARCHANTIALES[2]

Plants thalloid, dorsiventral, flat, ribbon-like, thick or thin; in most species with a porose dorsal epidermis, a photosynthetic middle layer and a basal compact layer bearing rhizoids and scales, dichotomously branched or with secondary branches from the median ventral region. Rhizoids unicellular, unbranched, usually of 2 kinds, the one with smooth walls, the other with internal peg-like or crescentic thickenings. Chloroplasts small,

[1]hĕp ăt′ ĭ sē.
[2]mär shăn″ shĭ ā′ lēs. In the pronunciation of names of foreign origin we have retained as much of the original sound as English sounds and good sense permit.

numerous, discoid. Thalli unisexual or bisexual. Sex organs dorsal. Antheridia short-stalked, more or less elongate, in deep depressions. Archegonia with long neck containing 4-8 canal cells; mature archegonium well developed, irregularly ruptured by the sporophyte. Mature sporophyte composed of sporangium only, or also with a stalk and foot; foot small or large, usually bluntly conic, stalk short when present; sporangium with few or no chloroplasts, its wall only 1 cell thick, or thicker at tip or base or both; spore mother-cells forming only spores, or usually also sterile cells, in most species the sterile cells become spiral elaters; dehiscence irregular by rupture, or somewhat regular by valves or an apical lid.

Sporophyte consisting of sporangium only; sterile cells wanting within the sporangium wall (sometimes present in *Oxymitra*); spores set free by disintegration of the sporangium wall and of the adjacent tissues; thalli without specialized reproductive branches..... *Ricciaceae*, p. 8

Sporophyte consisting of sporangium with stalk and foot; sterile cells present within the sporangium wall, commonly as elaters; spores set free by rupture of the sporangium; thalli of many species with specialized reproductive branches..... *Marchantiaceae*, p. 42

RICCIACEAE[3]

Gametophyte thalloid, annual or perennial, on ground or in water, dichotomously branched, often rosette-like. Rhizoids none on water forms, common on land forms, of 2 kinds on the same plant except in *Riccia frostii*, the one with smooth walls, the other with peg-like interior thickenings. Ventral scales from none to conspicuous. Pores from none to well developed. Thalli bisexual or unisexual; antheridia and archegonia arising on the dorsal side just back of the tip, soon deeply immersed; antheridial cavity with surface opening (ostiole) which is commonly elevated above the surface of the thallus; archegonium commonly with protruding neck. Sporophyte composed of a sporangium only, without stalk or foot, remaining within the distended archegonium, the wall of the sporangium 1 cell thick (or in *Oxymitra* thicker at tip or base or both), disintegrating when the spores are mature. Cells within the sporangium wall all producing spores, or a few remaining as sterile cells *(Oxymitra)*. Spores separating before maturity (or in *Oxymitra* at maturity), or remaining permanently united in tetrads *(Riccia curtisii)*, subspherical or in more or less the form of spherical tetrahedrons, the outer face commonly reticulate and sometimes the inner faces also, sometimes spinose on surfaces or margins.

[3] ˈrĭk″ sĭ ă′ sē ē. We have followed very largely Howe's treatment of the family in N. Amer. Fl. 14:11-27. 1923.

Sporophyte without an involucre; pores not stellate, the walls radiating from them not greatly thickened.
Thalli on damp or wet soil, or suspended in water but not floating; antheridia and archegonia scattered..... *Riccia*, p. 11
Thalli floating to stranded or rarely on very wet soil; antheridia and archegonia in the median groove..... *Ricciocarpus*, p. 38
Sporophyte with a conspicuous conic or triangular-pyramidal involucre; pores stellate due to the greatly thickened walls radiating from them..... *Oxymitra*, p. 40

Relationships among the North American Ricciaceae

The figure on page 10 shows, diagrammatically, the concept of the relationships among our Ricciaceae, although it should be remembered that, on the same evidence, individual judgments will differ. The letters correspond to those in the figure. Under the letters below are discussed matters pertinent to the respective points in the diagram.

(A)[4] The hypothetical common ancestor is conceived as having a gametophyte filamentous, branched, apical in growth; rhizoids simple, unseptate; sperm cells constituting male filaments and giving rise to one sperm each; sperms coiled, biciliate; the egg one enlarged cell in a branch, and covered by sterile branches. Fertilized egg with heavy wall; reduction division taking place at once on germination, and resulting in 4 haploid cells each of which could grow into a new haploid plant.

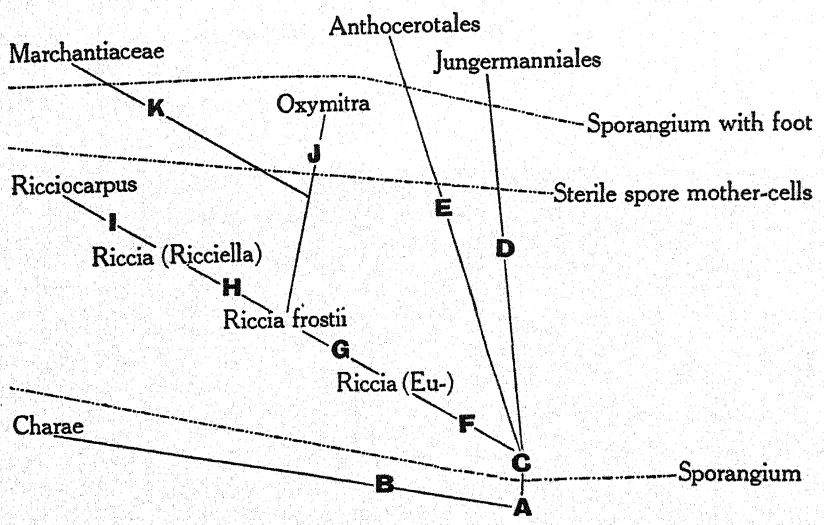
(B) The hypothetical development of a strong habit of alternating long and short cells even in rhizoids and sexual branches; the outer two layers of the antheridium sterile and forming the wall and its supports; coherence of the sterile branches which form the wall of the archegonium; the egg cell terminal. Reduction division probably occurring at once without the completion of haploid spores, and only one of the 4 nuclei giving rise to a new plant.

(C) The hypothetical development of a dorsiventral habit and closely coherent branches, the haploid body thus becoming the liverwort thallus; sex organs dorsal; antheridium a terminal cell of a male filament divided in 3 dimensions, the outer layer of cells remaining sterile; coherence and confusion of the filaments forming the wall of the archegonium; the egg not terminal, without heavy wall. Formation of a sphere of diploid cells of which all but the outer layer undergo reduction division, each forming a tetrad of spores.

[4]The relation of the Charales to other plants, and therefore their classification, has been a question with most botanical comparative morphologists. The coiled biciliate sperms seem to relate the Charales, Hepaticae, Musci, and Lycopodiales. Further, the female organ of the Charales is very close to the hepatic archegonium, although it differs somewhat, apparently mostly on account of the fixed nodal and internodal habit in the Charales. The evidence points to a closer relation to the Bryophytes than to the Thallophytes. This affinity is better shown by putting under Bryophyta the subgroups Musci, Hepaticae and Charae, than by using Charophyta equal in rank to Bryophyta.

(D) Tendency of the thallus to remain thin and without intercellular air spaces. Sporophyte with foot and stalk; sporangium with sterile diploid cells among the spore mother-cells; sex organs in special envelopes.

(E) Tendency of thallus to grow rather thick and to form intercellular air spaces which open ventrally; normally with one chloroplast per cell. Sporophyte with foot; sporangium youngest at its base, with columella, its wall several cells thick.



Philogenetic diagram of the Ricciaceae and related groups.

(F) Tendency of thallus to grow rather thick and to form intercellular air spaces which open dorsally; dorsal portion of thallus specially fitted for photosynthesis, air spaces between vertical columns of cells; nearly always some rhizoids with peg-like thickenings.

(G) Partly with vertical air spaces between columns of cells and partly with air chambers.

(H) Layer of air chambers usually more than one chamber deep, with one opening in the surface for each chamber which reaches the dorsal epidermis.

(I) Sex organs limited to the dorsal groove.

(J) Layer of air chambers remaining only one chamber deep; cells bounding the pores quite unlike the other epidermal cells; sex organs

limited to the dorsal groove. Sterile diploid cells sometimes appearing among the spore mother-cells, but never forming spiral elaters; wall of sporangium sometimes several cells thick at base, thus foreshadowing a foot.

(K) With or without green filaments in the air chambers; with or without thickened walls of cells bounding the pores; sex organs grouped in receptacles, the archegonium surrounded by more or less of an involucre. Sporangium with a stalk and foot, with sterile cells within the sporangium but never with spiral elaters, dehiscing irregularly.

RICCIA[5] L. Sp. Pl. 1138, 1753.

Ricciella A. Br., Flora 4:756, 1821.
Cryptocarpus Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869):231, 1870.
Thallocarpus Lindb. Not. Saellsk. Fauna et Fl. Fennica 13:377, 1874.
Angiocarpus Trev., Mem. Istit. Lomb. 13:444, 1877.

Thalli on the ground (or *R. fluitans* usually in fresh water), annual or more or less perennial, usually several times dichotomously branched. Upper surface often lacunose or spongiose through the disintegration of the roofs of the air chambers. Dorsal groove usually present. Margin sometimes ciliate or bristly, sometimes with projecting ventral scales, often a different color from the surface of the thallus. Chief segments linear to elliptic, or widest below or above the middle. Rhizoids almost wanting in aquatic forms, common on land forms. Ventral scales from obsolete to conspicuous, rarely projecting beyond the margin; in color hyaline-albescent, violet, violet purple, or brownish. Dorsal epidermis commonly somewhat areolate or alveolate under hand lens; outer layer of cells often soon collapsing and more or less disintegrating. Air chambers as spaces between vertical columns of photosynthetic cells or as polyhedral hollows bounded by unistratose walls. Basal or costal tissue well developed to much reduced, nearly or wholly without chlorophyll. Pores very inconspicuous, the surrounding epidermal cells not or hardly modified. Thalli usually bisexual, in some species unisexual; antheridia and archegonia scattered, on bisexual thalli, the two intermingled or rarely somewhat segregated, without special involucre; wall of the calyptra of two layers of cells but the inner usually absorbed before maturity of the sporophyte. Sporangium with unistratose wall throughout, soon disintegrating. Spores separating before maturity (or in *R. curtisii* permanently united in tetrads), without sterile cells among them.—Named in honor of P. F. Ricci, an Italian botanist.

[5] rĭk' sĭ ä.

A. Photosynthetic tissue with narrow vertical or subvertical air canals,[6] or sometimes with polyhedral air chambers in the wings of the thallus.
  B. Margin of the thallus without cilia although sometimes with papillae.
    C. Dorsal surface more or less green, not calcified.
      D. Ventral scales usually inconspicuous, not reaching the margin or sometimes extending slightly beyond it especially near the tip.
        E. Wing margin of the spore wanting; spores obscurely or not at all angular.
          F. Margin of thallus and ventral scales blackish purple; hypodermal cells of thallus not in distinct rows..... 1. *R. dictyospora.*
          FF. Margin of thallus and ventral scales violet purple to decolorate; hypodermal cells of thallus in distinct rows..... 2. *R. macallisteri.*
        EE. Wing margin of the spore 3 or more μ wide; spores angular.
          G. Ventral scales whitish-hyaline or brownish, rarely tinged with violet purple.
            H. Cells containing oil bodies wanting; margin of the thallus green or hyaline, or occasionally violet.
              I. Dorsal groove obtuse, wide, commonly occupying a third or more of the width of the thallus.
                J. Thalli mostly 3-6 mm long, their segments mostly 1-1.5 mm wide; antheridial ostioles inconspicuous, elevated 0-25 μ; inner and outer faces of the spores almost equally areolate-alveolate..... 3. *R. bifurca*[7].
                JJ. Thalli 6-10 mm long, their segments mostly 1.5-2.5 mm wide; antheridial ostioles elevated 75-160 μ; inner faces of the spores less strongly areolate than the outer..... 4. *R. glauca.*
              II. Dorsal groove acute, narrow..... 6. *R. sorocarpa.*
            HH. Cells containing oil bodies usually present in various parts of the thallus; margin of the thallus commonly yellowish brown, thin, membranous; antheridial ostioles elevated 100-170 μ..... 7. *R. campbelliana.*
          GG. Ventral scales blackish purple; segments of the thallus 0.75-1.5 mm wide; antheridial ostioles not at all or only slightly elevated..... 8. *R. nigrella.*
      DD. Ventral scales conspicuous, extending considerably beyond the margin, whitish-hyaline; spores 75-126 μ in longest diameter, obscurely angular, wing margin wanting or rudimentary..... 9. *R. austini.*
    CC. Dorsal surface of the thallus chalk white, calcified..... 5. *R. albida.*
  BB. Margin of the thallus normally bearing few to many cilia or setae.
    K. Thalli bisexual; segments of the thallus 0.6-2.5 mm wide; spores 65-140 μ in longest diameter.
      L. Cilia 50-400 μ long, none on dorsal epidermis above the sporangia.
        M. Antheridial ostioles elevated 0-30 μ; cilia slender.

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[6] *Riccia frostii* has chambers sometimes long and narrow, and when so, may be sought here. It is on the border line between those species with columnar air chambers and those with polyhedral ones.

[7] Very rarely this has a few cilia at the margin.

N. Cilia 150-400 μ long; dorsal groove wide; spores 65-90 μ in longest diameter; areolae of outer face of spore mostly 6-10 μ wide..... 10. *R. californica.*
NN. Cilia 50-150 μ long; dorsal groove narrow; spores 90-135 μ in longest diameter; areolae of outer face of spore mostly 10-13 μ wide..... 11. *R. hirta.*
MM. Antheridial ostioles elevated 60-200 μ; cilia stout, usually few; spores 65-140 μ..... 13. *R. beyrichiana.*
LL. Cilia 300-900 μ long, commonly 1-12 on dorsal surface over each sporangium; spores 90-125 μ in longest diameter, soon black and very opaque..... 12. *R. trichocarpa.*
KK. Thalli unisexual; segments of the thallus 2-7 mm wide; spores 130-190 μ in longest diameter, soon black and very opaque..... 14. *R. donnellii.*
AA. Photosynthetic tissue with more or less widely polyhedral or clavate-polyhedral air chambers separated by walls only 1 cell thick; margin of the thallus without cilia; ventral scales wanting or rudimentary.
O. Thallus on the ground, attached, its segments somewhat wider than narrowly linear.
P. Mature spores remaining attached in tetrads. (True of only this one species of *Riccia*)..... 16. *R. curtisii.*
PP. Mature spores no longer grouped in tetrads.
Q. Spores ellipsoid or subglobose to ovoid, 45-65 μ in longest diameter, not areolate, densely spinose..... 17. *R. membranacea.*
QQ. Spores angular, areolate or ridged, if spinulose not densely so.
R. Spores marked with short delicate ridges which rarely anastomose, 40-65 μ in longest diameter; thalli unisexual..... 15. *R. frostii.*
RR. Spores areolate at least on the outer face, often more than 65 μ in longest diameter; thalli bisexual.
S. Areolae of the outer face of the spore 10-30 μ wide, sometimes enclosing a free-ending spur or an isolated tubercule; outer layer of cells of dorsal epidermis soon indeterminate..... 18. *R. crystallina.*
SS. Areolae of the outer face of the spore 8-13 μ wide, without enclosed free-ending spurs or isolated tubercles; outer layer of cells of dorsal epidermis persistent..... 19. *R. sullivantii.*
OO. Thalli free-floating or stranded, not attached, the segments narrowly linear; areolae of outer face of spore 12-25 μ wide, the larger enclosing a free-ending spur or an isolated tubercle; spores not spinose..... 20. *R. fluitans.*

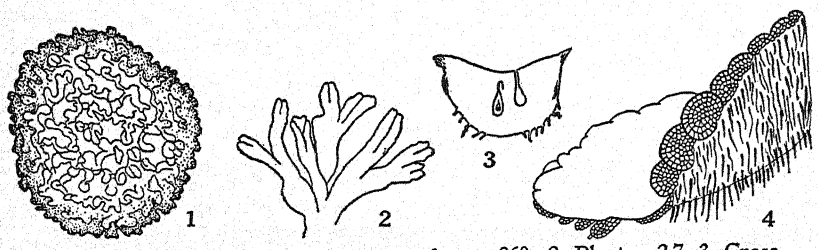
Section *Euriccia.*[8] Photosynthetic layer composed of vertical filaments.

1. **Riccia dictyospora**[9] Howe, Bull. Torr. Bot. Club 28:163, 1901.

Thalli medium sized, 4-10 mm long, irregularly gregarious, 0-2 times dichotomous, light green or sometimes darkening, with narrow blackish purple border. Upper surface reticulate. Dorsal groove acute, rather sharply defined toward the apex. Margin narrowly blackish purple, naked, not papillate, thin, submembranous, ascending, more or less crenate-un-

[8] ū rĭk' sĭ ä.
[9] dĭk tĭ ŏs' pōr ä.

dulate. Chief segments oblong to long-obovate or rarely sublinear, 1-2 mm wide, subacute or obtuse; cross section 1.5-3 times as wide as high, concavo-parabolic, becoming plano-convex. Ventral scales blackish purple, slightly exceeding the margins, entire. Dorsal epidermis 2-stratose, usually with abundant oil cells; its outer stratum of cells thin walled, dome-shaped or oval-papilliform, very soon collapsing and either disintegrating or leaving rather obscure vestiges, cells of the second layer mostly 20-42 μ wide; oil cells usually abundant. Thalli bisexual; antheridial osti-



Riccia dictyospora. 1, Spore, outer face, x 260. 2, Plant, x 2.7. 3, Cross section of thallus in outline, x 12.7. 4, Portion of plant twisted to show latero-ventral scales, x 22. (All after Haynes.)

oles often slightly elevated, 0-50 μ high. Spores soon exposed, scarcely angled, somewhat flattened, 90-135 μ in longest diameter, rough, papillate-echinulate in profile, brown, rather translucent; wing margin wholly wanting; outer face areolate; the areolae 8-12 μ wide, the boundaries sometimes broken into papillae or ridges; the papillae truncate or obtuse, 2-9 μ long, inner face with slightly longer and less regular areolae, rather more papillate than the outer. Gk. *dictyon,* a net; the spores are reticulate over the whole surface.—On moist soil.

ILLUSTRATIONS: Haynes, Bull. Torr. Bot. Club 47: pl. 11, figs. 1-5, 1920. EXAMINATIONS:[10]—*Conn.* Woodbridge (Lorenz) 1911.

TYPE LOCALITY: Oconee River, Athens, Georgia (Harper) 1900. RANGE:[11] Conn. (270), N. C. (43), Ga. (297), Tex. (305).[12]

2. **Riccia macallisteri**[13] Howe, Bryologist 20:35, 1917.

Thalli medium-sized, 5-8 mm long, often forming densely gregarious more or less radiating masses, 2-3 times rather divergently forked, bright green when living, often whitish green or yellowish green when dry or old, violet purple or sometimes decolorate at margins and on sides. Upper surface regularly reticulate. Dorsal groove acute and sharply defined in

[10]Only a limited number of those examined are mentioned for most species.

[11]Ranges are largely as reported in literature. In a work of this kind time does not permit the examination of all species from all states and countries even if one had the collections at hand.

[12]Evans (157) reported it from Missouri but later (194) referred the Missouri material to *R. macallisteri.*

[13]măk ăl' lĭs tĕr ī".

anterior parts, becoming obscure in the posterior. Margin violet purplish or decolorate, naked, not papillate, acute, unistratose for 1-2 cells. Chief segments oblong or oblong-obovate, 1.5-2.5 mm wide; cross section mostly 2-3 times as wide as high, 18-25 cells thick in median region, the ventral outline rounded-convex or occasionally somewhat flattish; terminal segments ovate to subquadrate or somewhat obcordate, rounded-obtuse or subacute. Ventral scales reddish violet to claret colored or sometimes decolorate, imbricate, slightly exceeding the margin, entire. Dorsal epidermis of 2-3 layers of cells; cells of the outer layer mostly mammiform-apiculate, soon collapsing and leaving rather inconspicuous vestiges; cells of the second layer mostly 26-78 μ wide; cells under the second layer mostly in very distinct and regular rows in surface view. Thalli bisexual; antheridial ostioles elevated 50-160 μ, often violet. Sporangia usually numerous, soon exposed, with the spore masses showing in a deep widely open pit or trough. Spores ellipsoid or ovoid to subspheric or obscurely tetrahedral, 78-132 μ in longest diameter, rough, at first violet or violet brown, later violet black and opaque; wing margin wholly wanting; outer face areolate, finally densely echinulate; areolae 7-15 μ in diameter and soon obscure; spinules 5-11 μ long, truncate to obtuse or occasionally subacute, sometimes cristate-furcate; inner faces like the outer. Named in honor of Dr. F. McAllister, who first found it.—On moist ground.

ILLUSTRATIONS: Howe, Bryologist 20: pl. 3, fig. 2, 1917. EXAMINATIONS:—*Tex.* Granite Mountain (McAllister) 1914; Bastrop (McAllister) 1932.

TYPE LOCALITY: On moist ground near standing water in quarry holes, at Granite Mountain, about 70 miles northwest of Austin, Texas (McAllister) May 1914. RANGE: Mo. (194), Neb. (204), Tex. (304).

The two collections of this plant which we have examined show violet scales, decolorate margins of the thallus, hypodermal cells of the thallus in distinct rows, the blunt or truncate spines of the spores, as described for *R. macallisteri*. However, they showed the spores light brown, becoming dark brown; the areolae of the spores visible throughout, instead of the spores opaque; the antheridial ostioles mostly under 50 μ high, only a few of the highest 55-70 μ high, instead of ostiole 50-160 μ high. These are more nearly as described for *R. dictyospora*. This leaves one in doubt whether *R. macallisteri* is sufficiently distinct to merit specific rank, or would have its relation and importance better expressed as *R. dictyospora* var. *macallisteri*.

The material at hand is dried and not good for accurate illustrations, which should be made from living material.

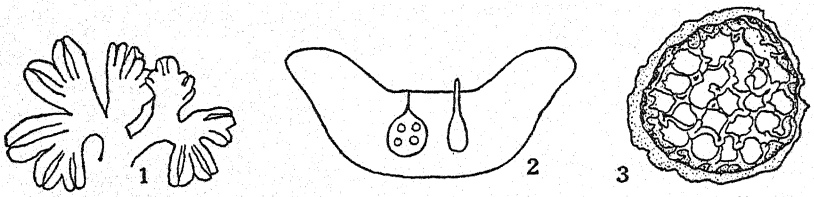
3. **Riccia bifurca**[14] Hoffm. Deutsch. Fl. 95, 1795.

R. arvensis Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869) :232, 1870.
R. subcrispula Warnst. Krypt-Fl. Mark Brandenburg 1 :76, 1902.

Thalli rather small, mostly 3-6 mm long and irregularly gregarious, or forming rosettes 5-10 mm in diameter, usually 2-3 times dichotomous, dull grayish green, or sometimes the sides and margins tinged with violet

[14] bī fûr' kä.

purple. Chief segments oblong or obcuneate-subquadrate, 0.6-2 mm wide; cross section concavo-parabolic or canaliculato-trapezoidal, becoming subelliptic in older parts, mostly 2-4 times as wide as high, 16-26 cells high in median region, the cells chlorophyllose almost or quite to the ventral epidermis, the ventral line convex or more or less straight; terminal segments subquadrate or subquadrate-ovate, rounded-obtuse, often emarginate. Upper surface somewhat obscurely reticulate, often minutely furfuraceous on drying. Dorsal groove often narrow at apex, broadening in



Riccia bifurca. 1, Plant, x 2.7. 2, Outline of cross section of thallus, x 16.7. 3, Spore, outer face, x 260. (1, after K. Mueller; 2, after Casares-Gil; 3, after Haynes.)

older parts to a narrow channel occupying about ⅓ the width of the thallus, becoming obsolete toward base. Margin occasionally tinged with violet purple, naked or very rarely with occasional short rather flaccid cilia, subacute or obtuse, often somewhat alate. Ventral scales hyaline or sometimes tinged with violet purple, not reaching margins, small. Dorsal epidermis 1-2-stratose; cells of the outer layer rounded-obtuse or conic-mammillate, soon collapsing and leaving irregular vestiges; cells of the second stratum subglobose to ellipsoid or polyhedral, 35-70 μ wide, often wider than high. Thalli bisexual; antheridial ostioles inconspicuous, sometimes elevated 25 μ. Sporangia usually numerous, often crowded, long included. Spores angular, 68-115 μ in greatest diameter, rough, dark brown; wing margin 3-12 μ wide, granulate-papillate or crenulate to lobulate-cristulate; outer face areolate, in profile showing granulate crests or truncate papillae 3-5 μ high; areolae 6-15 μ wide; inner faces similar to the outer one or a little less strongly marked. L. *bifurcus,* divided into 2 branches, a common condition in this and most other species.—On damp ground.

ILLUSTRATIONS:[15] Haynes, Bull. Torr. Bot. Club 47: pl. 12, figs. 1-6, 1920; K. Mueller (409) 1: figs. 119-120; Pearson (433) pl. 219; Warnstorf (523) 77 and 79, figs. 3a-3c, 3e; Macvicar (374) 19, figs. 1-3; Gil (76) fig. 121. EXAMINATIONS:—*Me.* Canton (Parlin 8479).—*Conn.* Orange (Evans) 1899; Salem (Lorenz) 1923; Hartford (Conklin 2389) 1923.—*Wis.* Afton (Cheney 12871) 1928.

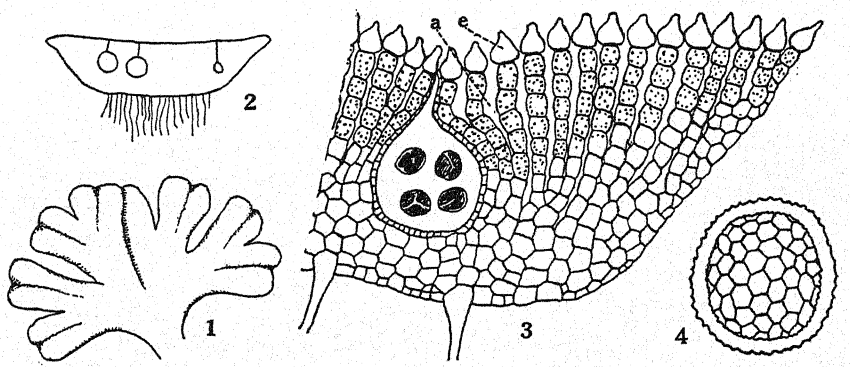
TYPE LOCALITY: European. RANGE: Greenland (409), Me. (200), N. H. (185), Vt. (185), Mass. (176), R. I. (140), Conn. (212), N. Y. (164), Que. (178), Pa. (164), Ont. (512), Ind. (270), Wis. (98), Tex. (270), N. C. (43), Md. (212), D. C. (343), N. J. (164); Eur. (325).

[15]Reference cannot be made to all figures. We have endeavored to list the more important from the taxonomic viewpoint.

4. **Riccia glauca**[16] L. Sp. Pl. 1139, 1753.

R. venosa Roth. Fl. Germ. 433, 1803.
R. lindenbergii Sauter, G. L. & N. Syn. Hep. 611, 1846, in part.
R. ruppinensis Warnst. Krypt.-Fl. Mark Brandenburg 1:71, 1902.

Thalli medium sized, 6-10 mm long, at first subradiate, later confluent and irregularly gregarious, 2-4 times dichotomous, light green or subglaucous above, below either the same or blackening. Upper surface reticulate. Dorsal groove obtuse, broad, occupying ⅓ or more of the width of the thallus, soon vanishing toward the base. Margin naked, acute or subobtuse, mostly rather thin, usually ascending. Chief segments oblong or obcuneate, mostly 1.5-2.5 mm wide; cross section oblong or subelliptic to



Riccia glauca. 1, Plant, x 10. 2, Outline of cross section of thallus, x 10.7. 3, Portion of cross section of thallus, (*a*) air chamber, (*e*) epidermal cell, x 66.7. 4, Spores, usually much more angular, x 240. (1, after Meylan; 2, after Pearson; 3, after K. Mueller.)

crescentic, mostly 4-5 times as wide as high, in median region 15-25 cells high, ventral line slightly convex or nearly straight; terminal segments subquadrate or obovate to lingulate, obtuse to emarginate-retuse. Ventral scales rarely darkening, usually colorless, inconspicuous. Dorsal epidermis 2-stratose (figured 1-stratose by K. Mueller in Rabenhorst's Krypt.-Fl. 6 (1): fig. 5); cells of the upper layer hemispheric-ellipsoid or ovoid, obtuse or conic-mammillate, soon collapsing and leaving imperfect cups or irregular vestiges; cells of the second layer mostly 30-80 μ wide, commonly wider than high. Air chambers abundant, columnar, in only 1 series vertically; walls unistratose. Thalli bisexual; antheridial ostioles elevated 75-160 μ. Sporangia usually numerous, long included. Spores angular, 75-118 μ in greatest diameter, rough, brown; wing margin of spore 5-13 μ wide, smooth or subgranulate, more or less crenulate; outer face areolate, in profile papillate; areolae mostly 5-13 μ wide; papillae obtuse,

[16]glą̈w' kā.

1-5 μ long; inner faces similar to outer but less strongly marked. Named from its commonly subglaucous upper surface.—On moist clayey ground and shady banks.

ILLUSTRATIONS: Lindenberg, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 18: pl. 19, 1836; K. Mueller (409) 1: figs. 5, 97, 123a; Pearson (433) pl. 116; Warnstorf (523) 74, fig. 1; Meylan (386) fig. 16; Macvicar (374) 22, figs. 1-3. EXAMINATIONS: —*Wyo.* Fremont Lake in Sublette County (Payson 2816) 1922.—*Wash.* Carrolls (Rakestraw) 1936.—*Ore.* Fifteen Mile Meadow in Wasco County (Jones 4129) 1933; Buell (Rakestraw) 1936.—*Cal.* Echo Lake in Eldorado County (Carter 369) 1933; Yosemite Valley (Carter 586) 1934.

TYPE LOCALITY: England. RANGE: Wyo. (446), Wash., Ore. (457), Cal. (296), Ariz. (184), Tex. (305), Neb. (204); West Indies (478); S. Amer. (401); Asia (350); Eur. (329); Africa (400).

5. **Riccia albida**[17] Sull., Proc. Acad. Nat. Sci. Philadelphia 21 (1869):231, 1870.

Thalli small, mostly 2-4 mm long, irregularly gregarious, 1-3 times dichotomous, chalk white and more or less calcified.[18] Upper surface alveolate-reticulate or spongiose both when living and when dry. Dorsal groove narrow, rather acute, 1/6-1/10 the width of the thallus, persistent. Margin white or albescent, naked or minutely papillose, obtuse or rounded. Chief segments oblong or cuneate-oblong to subquadrate, 0.7-1.1 mm wide; cross section subelliptic or semi-orbicular, mostly 1.5-2 times as wide as high; 18-24 cells high in median region; terminal segments quadrate or subquadrate-ovate, obtuse. Ventral scales invisible in ordinary examination, minute. Dorsal epidermis of 1-6 layers of cells, decolorate, more or less calcified; cells of the outer layer persistent, rounded-obtuse or truncate to mammillate or apiculate; 26-40 μ wide, extremely variable in form. Pores or canals often enlarged. Thalli unisexual (with some doubt); antheridial ostioles scarcely elevated. Spores yellowish, obscurely angular, 65-85 μ in longest diameter, nearly smooth, yellowish brown (but perhaps immature), the extine readily delaminating; wing margin wanting to imperfectly developed, sometimes appearing only as an elevation at each of the 4 main angles; outer face nearly smooth or occasionally showing low irregular wrinkles or warts; inner faces same as the outer. L. *albida,* white; from the milk white upper epidermis. Habitat not stated.

ILLUSTRATIONS: None. EXAMINATIONS:—*Tex.* Miller's Ranch in Real County (collector?) 1925; New Braunfels (McAllister) 1934.

TYPE LOCALITY: Texas (Dr. Charles Wright) 1845. RANGE: Tex. (21), La.[19] (512).

We have seen only dried material with immature spores. While the thallus showed the species characteristics plainly, the dried material is not natural enough for dependable drawings.

[17]ăl' bĭ dă.

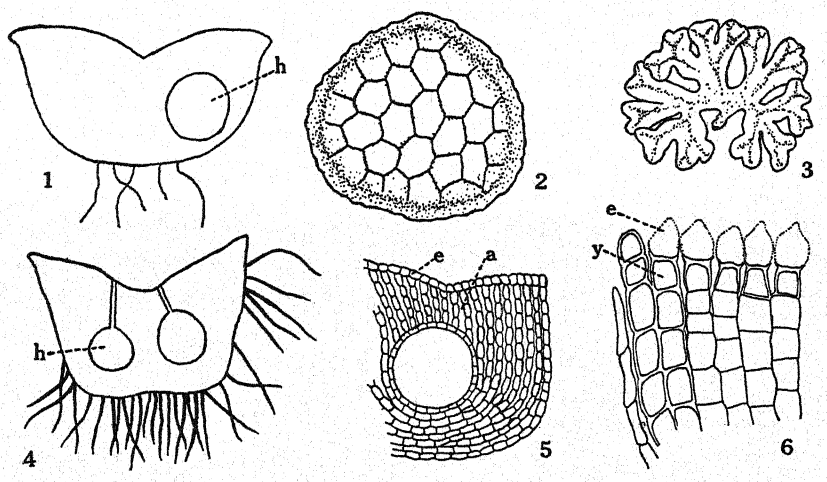
[18]It would be an interesting experiment to grow various species of *Riccia,* including *R. glauca, R. sorocarpa* and *R. donnellii* on a soil watered only with a nearly saturated solution of lime. An incrustation of lime might affect the form and structure.

[19]Underwood (512) says "I have received a single plant collected by Langlois in Louisiana." This seems to be the only basis for its inclusion from Louisiana.

6. **Riccia sorocarpa**[20] Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. Cur. 17:1053, pl. 71, fig. 11, 1835.

R. minima L. Sp. Pl. 1139, 1753, in part.
R. lindenbergiana Sauter, Flora 28:132, 1845.
R. epicarpa Wallr., G. L. & N. Syn. Hep. 600, 1846.
R. lindenbergii Sauter, G. L. & N. Syn. Hep. 611, 1846, in part.
R. raddiana Jack & Levier, Bull. Herb. Boissier 6:336, 1898.

Thalli rather small to medium sized, 4-9 mm long, at first subradiate, later irregularly gregarious in patches, 1-4 times dichotomous, clear bright subcrystalline light green above when living, lighter green when dry, the



Riccia sorocarpa. 1, Outline of cross section, (*h*) hollow in which the sporophyte was formed, x 24. 2, Spore, outer face, x 450. 3, Plant, x 2. 4, Outline of cross section, (*h*) hollow in which sporophyte was formed, x about 24. 5, Portion of cross section of thallus, (*a*) air chamber, (*e*) epidermal cell, x 80. 6, Small portion of cross section of thallus, (*e*) epidermal cell, dissolved, (*y*) hypodermal cell, thick walled, x 200. (6, after K. Mueller; 4, after Pearson; the others after Warnstorf.)

same below. Upper surface minutely regularly and compactly reticulate, sometimes nearly smooth when dry. Dorsal groove acute. Margin rarely violet, naked, usually sharply acute, often hyaline-membranous, commonly ascending, often incurved when dry. Chief segments oblong to oblong-obcuneate, 0.75-2 mm wide; cross section subquadrate or somewhat parabolic, mostly 1-2 but sometimes 4 times as wide as high, about 25 cells high in median region, the ventral line strongly convex to somewhat keeled; terminal segments oblong, subacute. Ventral scales whitish or hyaline, often reaching the margin at or near the apex, small. Dorsal epidermis 2-3 cells thick, cells of upper stratum at first papilliform, the lower portion of their lateral walls becoming thickened and the upper soon

[20] sō rō kär' pä.

vanishing, thus leaving persistent cups 30-75 μ wide attached to the likewise thick-walled second layer. Air chambers abundant, columnar, in only one series. Walls unistratose. Thalli bisexual; antheridial ostioles elevated about 80 μ, shortly cylindric. Sporangia usually numerous, somewhat emergent, protuberant with age. Spores angular, 67-100 μ in longest diameter, rough, dark brown; wing margin 3-6 μ wide, usually interrupted, brownish, granulate-papillate and crenulate, in profile with papillae usually 3-6 μ long; median areolae of outer face mostly 6-10 μ wide; inner faces densely and minutely punctate, or with very short and numerous minute ridges which do not form areolae. We infer that the name was applied from L. *sorus,* a heap, and *carpus,* a body; referring to the elevation of the surface over the sporangium with age and its final protrusion.—On moist sandy or stony soil or banks of earth.

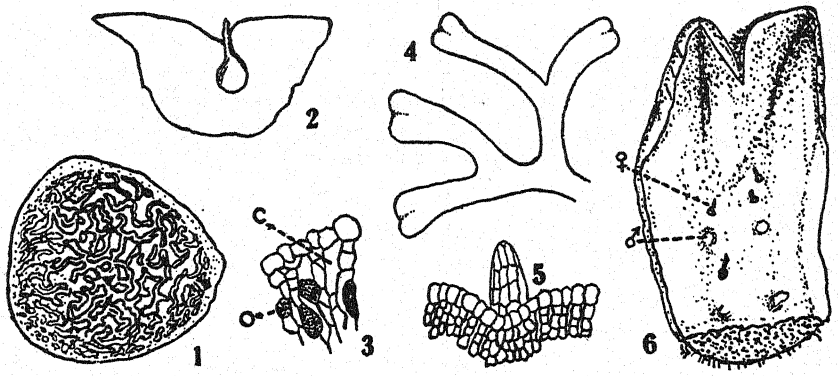
ILLUSTRATIONS: Bischoff, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17: pl. 17, fig. 2, 1835; K. Mueller (409) 1: figs. 101c, 131; Pearson (433) pl. 218; Macvicar (374) 24, figs. 1-5; Gil (76) figs. 20, 131. EXAMINATIONS:—*Conn.* New Haven (Evans) 1911; Hartford (Lorenz) 1912.—*N. C.* Durham (Bloomquist) 1923. —*Wis.* Glenhaven (Cheney 12245) 1927.—*Mont.* Logan Pass in Glacier Nat. Park (Frye) 1934.—*Wyo.* Veedawoo Glenn in Albany County (Porter 1750) 1935.—*Ida.* Tyndall (Miller) 1934.—*Ore.* Crater Lake Nat. Park (Frye) 1933.—*Cal.* Fair Oaks (Carter 404) 1933; Yosemite Nat. Park (Carter 565) 1934.

TYPE LOCALITY: Near Heidelberg, Germany. RANGE: Greenland (320), Mass. (305), Conn. (169), N. J. (506), N. Y. (506), Ill. (529), Wis. (98), Wyo. (446), Mont., Wash. (81), Ore. (239), Cal. (296), Ariz. (184), Okla. (354), Ala. (305), Fla. (337), S. C. (156), N. C. (43); Guadalupe Isl. w. of Mex. (306); Asia (409); Eur. (41); Africa (409).

7. Riccia campbelliana[21] Howe, Mem. Torr. Bot. Club 7:26, 1899.

Thalli medium or rather large, 4-18 mm long, loosely gregarious, rarely subradiate, 1-3 times dichotomous, light or brownish green, the same or brown or very rarely blackish beneath. Upper surface reticulate, often minutely scaly on drying. Dorsal groove acute, often obscure in older parts. Vein often somewhat keeled. Margin commonly yellowish brown, naked, thin, membranous, sometimes abruptly winged, when dry usually ascending to erect or inflexed-connivent. Chief segments oblong or oblong-linear, 1-3 mm wide; cross section subquadrate or oblong exclusive of margins, 2-5 times as wide as high inclusive of margins, 25-35 cells high in median region, the ventral outline rounded; terminal segments oblong or obovate, obtuse or sometimes subacute. Ventral scales brown or nearly colorless, sometimes slightly exceeding the margin at apex, usually inconspicuous. Dorsal epidermis unistratose; its cells 25-80 μ wide, elliptic-oblong, mostly higher than wide, long-persistent; oil cells numerous. Thalli bisexual; antheridial ostioles prominent, conic-cylindric, elevated 100-170 μ. Sporangia commonly numerous, finally erum-

[21] kăm″ ĕl ĭ ān′ ă.



Riccia campbelliana. 1, Spore, outer face, x 305. 2, Outline of cross section of segment of thallus, x 12. 3, Portion of cross section of thallus, (*c*) chamber, (*o*) oil cell, x 53. 4, Thallus, x 3. 5, Antheridial elevation, x 53. 6, Portion of plant, x 10. (All after Howe.)

pent and exposing the spores. Spores distinctly angular, 75-108 μ in longest diameter, somewhat rough, finally yellowish brown; wing margin 3-6 μ wide, minutely granular or nearly smooth; outer face in profile slightly papillate or nearly smooth, with close sinuose ridges which rarely form complete meshes, the imperfect areolae 4-7 μ wide; inner faces similar to outer but less strongly marked. Named in honor of Dr. D. H. Campbell, of Stanford University, who first found it.—On damp soil.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 91, figs. 1-15, 1899. EXAMINATIONS:—*Cal.* Fair Oaks (Carter 411) 1933; Tomales (Carter 520) 1934; Napa (Carter 452) 1934.

TYPE LOCALITY: Near Stanford University, California, (Campbell) 1896. RANGE: Cal. (299).

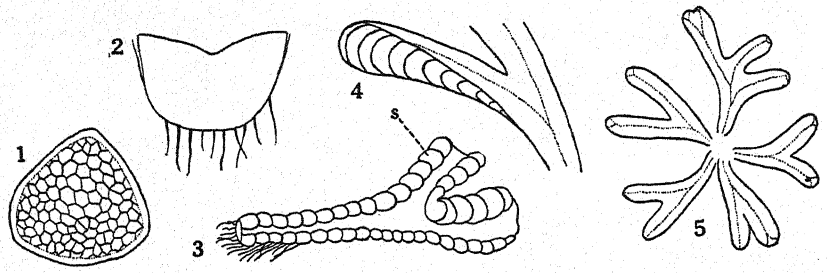
8. **Riccia nigrella**[22] DC. Fl. France 6:193, 1815.

R. minima L. Sp. Pl. 1139, 1753, in part.
R. minima Raddi, Opusc. Scient. Bologna 2:353, 1818.
R. aggregata Underw., Bot. Gaz. 19:275, 1894.
R. pearsoni Steph., Bull. Herb. Boissier 6:335, 1898.

Thalli small to medium, 2-8 mm long, at first subradiate, later commonly gregarious, 1-4 times dichotomous, dark green, on the under side dark purple to nearly black or rarely decolorate. Upper surface somewhat polished and closely reticulate. Dorsal groove narrow and acute toward apex, becoming obtuse and finally vanishing in older parts. Margin often brownish, naked, acute or slightly membranous or becoming rather obtuse in older parts, commonly erect-connivent when dry. Chief segments at first obovate, finally linear or linear-obcuneate, 0.75-1.5 mm wide; cross

[22]nī grĕl' lä.

section subquadrate-semiorbicular in young parts, subquadrate or oblong in older, 1-2.5 times as wide as high, mostly 18-25 cells high in the median region, the ventral outline almost straight or slightly convex toward apex; terminal segments obcuneate-oblong or elliptic-obovate, retuse or subacute. Ventral scales black purple and shining or rarely colorless, not ex-



Riccia nigrella. 1, Spore, outer face, x 240. 2, Outline of cross section of thallus, x 25. 3, Thallus, dorsal view (*s*) scale, x about 7. 4, Part of thallus, x 4.7. 5, Thallus, x 2.7. (4, after Casares-Gil; 2, after K. Mueller; 3, 5, after Pearson.)

ceeding the margin, transverse, semiorbicular. Dorsal epidermis unistratose; its cells slightly protuberant, subquadrate in vertical section, 25-55 μ wide, often wider than high, filled with a transparent and colorless or slightly granular, somewhat refringent fluid which reacts strongly with iron-haemotoxylin stain, the cells collapsed and disintegrated only in the oldest parts of the thallus. Air chambers narrow, inconspicous. Thalli bisexual; antheridial ostioles not at all or only very slightly elevated. Sporangia usually numerous, often crowded near the bases of the segments, the calyptra remaining long intact, usually bright green, commonly with a purple spot about the neck of the archegonium. Spores angular, 60-90 μ in greatest diameter, rough, brown, darker with age; wing margin minutely granular to nearly smooth, 3-6 μ wide, sometimes interrupted; outer face sinuosely ridged or irregularly areolate, often papillate in profile; papillae obtuse or truncate, 2-4 μ long; areolae 3-10 μ wide, commonly imperfect; inner faces rather more regularly areolate; meshes low, thick walled, scarcely papillate. Name from L. *niger,* black; referring to the conspicuous usually dark colored ventral scales.—On mud covered walls and on banks, or on rather dry rocky soil.

ILLUSTRATIONS: Lindenberg, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. pl. 29, 1836; Pearson (433) pl. 220; Macvicar (374) 25, figs. 1-5; Gil (76) figs. 108a, 130; K. Mueller (409) 1: fig. 133. EXAMINATIONS:—*Cal.* Azusa (Abrams 3124) 1903; San Diego (Haynes 2845) 1927; Palm Springs (Haynes 2693) 1927; Auburn (Carter 320) 1933.

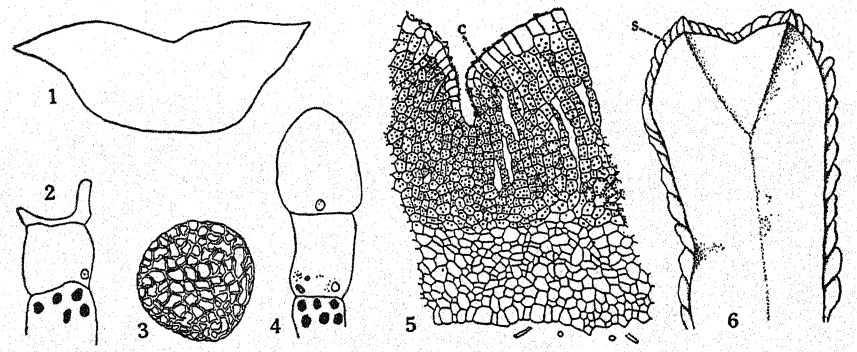
TYPE LOCALITY: Near Montpellier, France. RANGE: N. Y. (506), Pa. (164), Tex. (305), Cal. (296); Guadalupe Isl. w. of Mex. (306); Canary Isls. (407); Eur. (409); Africa (409).

Riccia nigrella based upon material from France is described as bisexual. In material collected at Barmouth in Wales, Pearson did not find male and female organs on the same plant. He referred some of the material to Stephani who erected a new species, *R. pearsoni* (491), describing it as unisexual. Pearson (433) could not distinguish *R. pearsoni* from French specimens since he could not find both kinds of sex organs on the same plant; thus he could not accept the new species as valid. Boulay (45) credits Crozals with pointing out that antheridial ostioles are difficult to find in dry herbarium material and in growing plants in unfavorable seasons. Thus it appears that both British and French plants are bisexual but one may have difficulty in finding both antheridia and archegonia on the same plant. *R. pearsoni* Steph. becomes a synonym. The ventral scales show at the margin when the plant is dry, which seems to be the condition from which figure 3 was originally drawn.

9. **Riccia austini**[23] Steph., Bull. Herb. Boissier 6:336, 1898.

R. lamellosa of Underw. in Bull. Ill. State Lab. Nat. Hist. 2:24, 1884; not of Raddi, Opusc. Scient. Bologna 2:351, 1818.
R. lamellosa americana Howe, Bull. Torr. Bot. Club 25:189, 1898.
R. americana Howe, Mem. Torr. Bot. Club 7:24, 1899.

Thalli medium sized, mostly 6-15 mm long, subradiate, often forming compact and more or less imbricate masses, 1-4 times dichotomous, pale green above and below. Upper surface regularly reticulate. Dorsal



Riccia austini. 1, Outline of cross section of thallus, x 14. 2, Vertical cells of thallus with the upper mostly dissolved, x 270. 3, Spore, outer face, x 122. 4, Vertical cells of thallus with epidermal cells intact, x 270. 5, Portion of cross section of thallus, (*c*) chamber, x 42. 6, Part of thallus, dorsal view, (*s*) scale, x 6. (All after Howe.)

groove acute, narrow, deep toward apex. Margin naked, acute, thin-membranous or subalate, ascending or when dry often erect-connivent. Chief segments oblong, 2.5-4 mm in maximum width; cross section subquadrate to oblong or somewhat parabolic, 1.5-3 or rarely 4 times as wide as high, 14-30 cells high in median region, ventral side about straight; terminal segments oblong to obcordate or obovate, obtuse or emarginate. Ventral scales colorless, patent or somewhat imbricate, extending considerably beyond the margin, large, subundulate, obtuse. Dorsal epidermis 2-stratose;

[23] aws' tin ī.

the cells of the primary stratum subglobose or ovoid-papilliform, soon collapsing and leaving irregular cup-like vestiges; the cells of the second stratum 30-75 μ wide; the cells of 2 or 3 strata next below the epidermis sometimes decolorate. Thalli bisexual; antheridial ostioles scarcely elevated or sometimes up to 150 μ. Sporangia with spongiose covering, protuberant, finally erumpent. Spores obscurely angled, 75-126 μ in longest diameter, rough, brown; wing margin wanting or rudimentary; outer face areolate; areolae of outer face 12-16 μ wide, clearly defined, commonly papillose in profile; papillae low, often obscure, 1-4 μ high; inner faces with smaller and much less distinct areolae, or simply marked with low irregular vermicular ridges. Named in honor of C. F. Austin who first found it.—On sandy soil.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 90, 1899. EXAMINATIONS: —*Conn.* Woodbridge (Lorenz) 1911.—*N. C.* Durham (Bloomquist) 1924.—*Cal.* San Francisco (Howe) 1896; Woodacre (Carter 931) 1933.

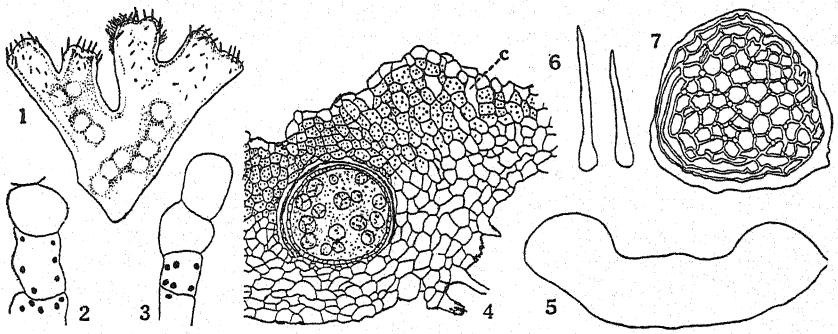
TYPE LOCALITY: Near Closter, New Jersey (Austin). RANGE: Conn. (305), R. I. (169), N. J. (506), Ont. (512), Neb. (204), Okla. (463), Tex. (305), Ala. (512), N. C. (97), Cal. (512).

Here belong the plants referred to *R. lamellosa* Raddi by Underwood in Bulletin of the Illinois State Laboratory of Natural History, 1884, and in the 6th edition of Gray's Manual of the Botany of the Northern United States, 1889.

10. Riccia californica[24] Aust., Bull. Torr. Bot. Club 6:46, 1875.

Thalli medium sized, forming rosettes 8-18 mm in diameter, dichotomously branched and its main segments 1-3 times so, light green and glaucescent, concolorous below. Upper surface reticulate. Dorsal groove wide, obtuse except at apex, vanishing toward base. Margin ciliate toward apex, commonly obtuse, elevated and somewhat tumid when young; cilia few or numerous, slender, taper-pointed, rather rigid, occasionally uncinate, minutely granular, 150-400 μ long, sometimes occurring sparingly on the dorsal surface, sometimes wholly wanting. Chief segments subquadrate or oblong-obcuneate, 1-2 mm wide; cross section canaliculate-elliptic, becoming parabolic toward base, 2-5 times as wide as high, 15-25 cells high in median region, ventral line more or less convex or nearly straight; terminal segments short-oblong or obovate, obtuse or subtruncate to retuse. Ventral scales rudimentary and inconspicuous. Dorsal epidermis 2-stratose; cells of the outer layer hemispheric to ellipsoid or papilliform, soon collapsing and leaving imperfect cups or irregular vestiges; cells of the second layer 40-80 μ wide, commonly wider than high. Thalli bisexual; antheridial ostioles very slightly or not at all elevated. Sporangia long included. Spores angular, 65-90 μ in longest diameter, papillate on outer face, brown, finally darkening; wing margin 3-12 μ wide, irregular-

[24] kăl ĭ fôr' nĭ kā.



Riccia californica. 1, Thallus, x 4. 2, Vertical filament with epidermal cell dissolved, x 180. 3, Vertical filament with epidermal cell intact, x 180. 4, Part of cross section of thallus, (*c*) chamber, x 42. 5, Outline of cross section of main segment, x 18. 6, Marginal hairs of thallus, x 53. 7, Spore, outer face, x 300. (All after Howe.)

ly crenulate, smooth; outer face areolate, in profile papillate; areolae 6-10 μ wide; papillae obtuse or truncate, 2-4 μ or less long; inner faces similar to outer but less strongly marked. Name from the state in which it was first found.—On lightly shaded banks.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 89, 1899. EXAMINATIONS: —*Cal.* Santa Clara (Bradshaw 3099) 1923; Deer Lake in Sierra County (Sutliffe) 1928; Napa (Carter 449) 1934.

TYPE LOCALITY: California (Bolander). RANGE:[25] Ore. (51), Cal. (504), Tex. (305).

11. Riccia hirta[26] (Aust.) Underw., Bot. Gaz. 19:274, 1894.

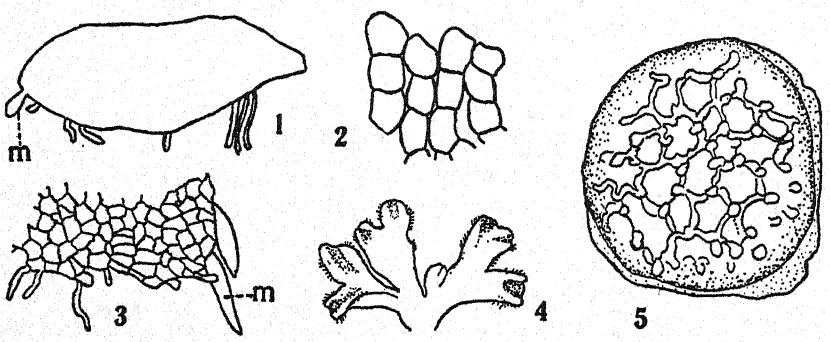
R. arvensis var. *hirta* Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869) :232, 1870.

Thalli usually small, 3-9 mm long, irregularly and often intricately gregarious, 1-4 times dichotomous, glaucous green when living, commonly albescent when dry, often somewhat purplish along the margins. Upper surface minutely and compactly but rather obscurely reticulate, becoming somewhat spongiose-furfuraceous on drying. Dorsal groove narrow and rather obtuse, abruptly defined on the younger parts, becoming shallow and obsolescent on the older. Margin often tinged with purple, ciliate, subacute or more often obtuse and rounded, subalate to not alate; cilia few, mostly slender and sharp pointed, rather rigid, nearly straight or slightly curved, minutely granulate, 50-100 μ long, occasionally wanting, occasionally also on dorsal surface. Chief segments oblong, 0.6-1.5 mm wide; cross section subquadrate to parabolic, mostly 1-2 times as wide as

[25]Evans (162) reported it from B. C., but later (194) referred the B. C. plant to *R. beyrichiana.*

[26]hûr' tă.

high, 20-30 cells high in median region, chlorophyllose almost or quite to the ventral epidermis, the ventral outline rounded; terminal segments oblong to subquadrate-ovate or sometimes obovate, obtuse. Ventral scales often dark purple, sometimes projecting very slightly at the extreme apex, few, inconspicuous. Dorsal epidermis 1-2-stratose; cells of the outer layer rounded-obtuse or mammillate, soon collapsing and leaving irregular vestiges or sometimes indurated and subpersistent; cells of the second lay-



Riccia hirta. 1, Outline of cross section of thallus, (*m*) marginal hair, x 33. 2, Vertical filaments of thallus, x 132. 3, Margin, (*m*) marginal hair, x 87. 4, Thallus, dorsal view, x 4. 5, Spore, outer face, x 390. (All after Haynes.)

er subglobose or ellipsoid, 24-40 μ wide, commonly wider than high. Thalli bisexual; antheridial ostioles elevated 0-30 μ. Sporangia usually numerous, often crowded, long included. Spores angular, 90-135 μ in longest diameter, not smooth, yellowish brown or when old dark brown. Wing margin 3-12 μ wide, granular-papillate or crenulate, interrupted; outer face areolate, in profile papillate; areolae mostly 10-13 μ wide; papillae obtuse or truncate, 2-4 μ long; inner faces less strongly or imperfectly areolate, in profile scarcely papillate. L. *hirtus,* hairy; from the ciliate margins as compared with *R. bifurca* of which it was first considered a variety.—In rocky places.

ILLUSTRATIONS: Haynes, Bull. Torr. Bot. Club 47: pl. 12, figs. 7-13, 1920. EXAMINATIONS:—*Conn.* Hartford (Conklin 2406) 1924.—*N. C.* Winston-Salem (Schallert) 1932.—*Ga.* Thomasville (Brown) 1923.

TYPE LOCALITY: Closter, New Jersey (Austin). RANGE: Conn. (270), N. J. (506), Neb. (204), Cal. (290), Tex. (270), La. (270), Ga. (52), N. C. (43).

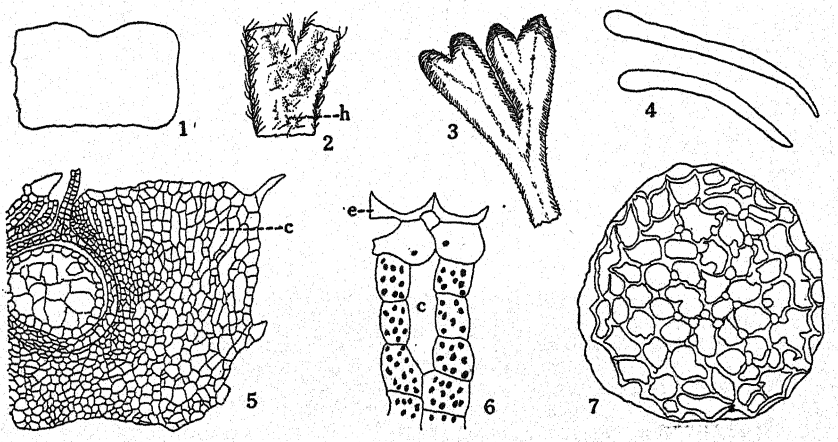
12. **Riccia trichocarpa**[27] Howe, Bull. Torr. Bot. Club 25:184, 1898.

R. ciliata of Underw., Bull. Ill. State Lab. Nat. Hist. 2:26, 1884; not of Hoffm. Deutschl. Fl. 95, 1795.

R. intumescens of Underw., Bull. Ill. State Lab. Nat. Hist. 2:26, 1898, in part. Not *R. ciliata* var. *intumescens* Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17:1063, pl. 71, fig. 4, 1835.

R. tumida of Underw. Syst. Bot. N. Amer. 9:7, 1895; not of Lindenb. Syn. Hep. Eur. 120, 1829.

Thalli medium sized, in rosettes 15-20 mm in diameter or irregularly radiating, 3-7 times dichotomous, light green, often blackening below and at margins. Upper surface regularly reticulate. Dorsal groove narrow and rather deep toward apex, obtuse or subacute, often nearly vanishing



Riccia trichocarpa. 1, Outline of cross section of thallus, x 23. 2, Portion of thallus, dorsal view, (*h*) hairs over sporangia, x 8. 3, Portion of thallus, dorsal view, x 4. 4, Marginal hairs of thallus, x 53. 5, Part of cross section of thalus, (*c*) chamber, x 53. 6, Vertical filaments, (*c*) chamber, (*e*) epidermal cell collapsed, x 225. 7, Spore, outer face, x 305. (All after Howe.)

near the base. Margin often blackish, densely ciliate, rounded, tumid, often connivent on drying; cilia white or tawny, usually rigid, rarely subuncinate, slenderly pointed, minutely granulate, 300-900 μ long, their walls unequally thickened. Chief segments linear, 0.75-1.5 mm wide; cross section subquadrate-oblong, 1.25-3 times as wide as high, 20-28 cells high in median region, ventral outline slightly convex toward apex but otherwise nearly rectilinear; terminal segments obcuneate or oblong-elliptic, obtuse or subacute. Ventral scales very inconspicuous. Dorsal epidermis 2-stratose; cells of the outer layer ovoid-papilliform or subhemispheric, soon collapsing and leaving irregular and finally inconspicuous vestiges; cells of the second stratum mostly 24-40 μ wide, often wider than high. Thalli bisexual; antheridial ostioles elevated 50-100 μ. Sporangia

[27] trī kō kär' pä.

numerous, long included, the overlying epidermis commonly marked with a dark purple spot and nearly always bearing 1-12 cilia. Spores angular, 90-125 μ in longest diameter, rough, soon black and very opaque; wing margin 1-5 μ wide, interrupted, often obsolete, granulate-papillate; outer face areolate, papillate; areolae visible only in young spores, 6-12 μ wide; papillae nearly always present, crowded, truncate, granulate, 2-5 μ long; inner faces similarly marked but scarcely papillate. Gr. *thrix,* hair and *carpos,* body; apparently from the densely ciliate margin of the thallus.—On rather dry rocky soil.

ILLUSTRATIONS: Howe, Bull. Torr. Bot. Club 25: pl. 337, 1898. Howe, Mem. Torr. Bot. Club 7: pl. 88, 1899. Gil (76) fig. 127. EXAMINATIONS:—*Cal.* Azusa (Abrams) 1903; Santa Catalina Isl. (Kingman 814) 1910; Claremont (Munz) 1920; San Gabriel Canyon (Carter 421) 1933; Auburn (Carter 322) 1933; Napa (Carter 450) 1934.

TYPE LOCALITY: Near Stanford University, California. RANGE: Tex. (354), Okla. (354), Ore. (51), Cal. (310); Lower California of Mex. (306); Gaudalupe Isl. w. of Mex. (306).

13. **Riccia beyrichiana**[28] Hampe, Lehm. Stirp. Pugill. 7:1, 1838.

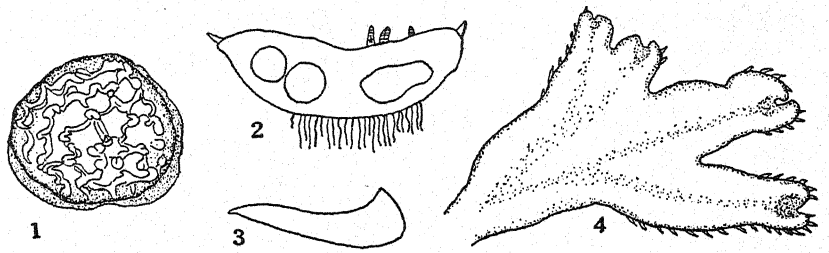
R. lescuriana var. *cruciata*[29] Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869): 232, 1870.
R. lescuriana var. *trichotoma*[29] Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869):232, 1870.
R. glaucescens Carr., Carr. & Pears. Hep. Brit. Exsic. No. 66, 1878.
R. glauca var. *ciliaris* Warnst., Verh. Bot. Brandenburg 27:87, 1885.
R. subinermis var. *crassa* Warnst., Verh. Bot. Brandenburg 41:20, 1899.
R. lesquereuxii Steph., Bull. Herb. Boissier 6:324, 1898.
R. glauca var. *subinermis* Warnst. Krypt.-Fl. Mark Brandenburg 1:70, 1902.
R. lescuriana var. *subinermis* Warnst. Krypt.-Fl. Mark Brandenburg 1:71, 1902.
R. lescuriana var. *glaucescens* K. Muell., Rabenhorst's Krypt.-Fl. Deutsch. Oesterr. und der Schweiz 6 (1):182, 1907.

Thalli medium sized or rather large, 5-10 mm long, gregarious or forming rosettes, mostly 1-4 times dichotomous, often with widely angled (30°-90°) forkings, light green above, concolorous below or reddish purple on sides and at margins. Dorsal surface reticulate. Dorsal groove flat bottomed, rather wide, 1/3-2/5 the width of the thallus, narrowed and apparently closed in front by convergence of margins. Vein occasionally subcarinate. Margin green or usually reddish purple, commonly subacute, abruptly ascending; cilia rarely wanting, usually few, in 1-2 series, stout, smooth or minutely granulate, 75-300 μ long, obtuse or sharply pointed, often curved. Chief segments linear-obcuneate or sometimes nearly obcordate, 1-2.5 mm wide; cross section mostly 2-4 times as wide as high, concavo-convex, becoming plano-convex in older parts; terminal segments ovate-elliptic to oblong, subacute. Ventral scales hyaline to whitish or

[28] bē″ rik ĭ ān′ ä.

[29] The two varieties of Austin are based upon variations in the cilia and are considered with the species.

sometimes purple, apico-ventral, usually very inconspicuous, few. Dorsal epidermis 2-3-stratose; cells of upper layer large, thin walled, dome-shaped, ovoid or obovoid to subhemispheric, 38-65 μ wide, soon collapsing and disintegrating or sometimes leaving obscure and irregularly persistent cups; the 1-3 layers beneath usually composed of enlarged and hyaline or subvacuous cells. Thalli bisexual; antheridial ostioles prominent, elevated



Riccia beyrichiana. 1, Spore, outer face, x 260. 2, Outline of cross section of thallus, x 16. 3, Marginal hair, x 29. 4, Portion of thallus, dorsal view, x 7.3. (1, after Haynes; the others after Pearson.)

60-200 μ. Sporangia with a naked and sometimes purple thallus covering. Spores angular or occasionally flattened, 65-140 μ in longest diameter, rough, brown to fuscous and sometimes opaque; wing margin 3-12 μ wide, slightly granulate, more or less interrupted or deficient; outer face strongly areolate, sometimes cristate-furcate, in profile nearly smooth to obscurely papillate; areolae mostly 10-18 μ wide; papillae truncate or obtuse; inner faces nearly smooth, occasionally very faintly and irregularly areolate. Named in honor of Beyrich, the original collector.—On soil in cultivated fields and on rocky ground.

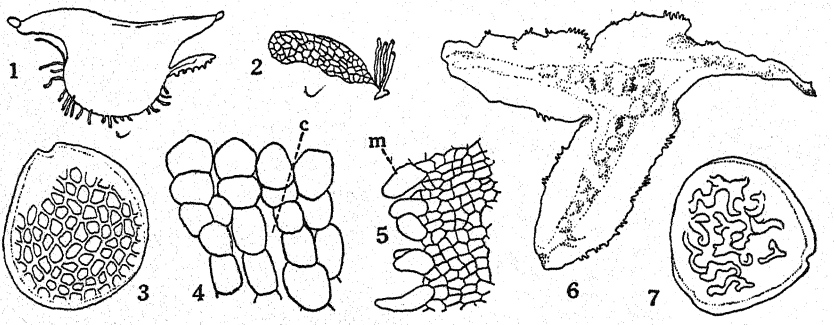
ILLUSTRATIONS: Haynes, Bull. Torr. Bot. Club 47: pl. 11, figs. 6-11, 1920; Pearson (433) pl. 222; Macvicar (374) 18, figs. 1-3; K. Mueller (409) 1: fig. 122; Warnstorf (523) 74, fig. 2. EXAMINATIONS:—*Mass.* Northampton (Lorenz) 1915.—*Conn.* West Hartford (Lorenz) 1911; New Haven (Haynes) 1911.—*Wis.* Grant County (Cheney 12205) 1927.—*Alta.* Dowling Lake (Brinkman) 1915.—*B. C.* Calling Lake (Brinkman 240) 1910.—*Wash.* Satus Creek (Rakestraw) 1936.—*Ida.* Bear Prairie (Rakestraw) 1934.—*Ore.* Cornucopia (Rakestraw) 1935; McKenzie Pass (Rakestraw) 1936.—*Cal.* Pasadena (Kingman) 1910; Medicine Lake (Rakestraw) 1936.

TYPE LOCALITY: Between Jefferson and Gainesville, Georgia[80] (Beyrich). RANGE: Mass. (270), Conn. (203), N. J. (164), N. Y. (4), Ill. (529), Wis. (98), Mo. (305), Neb. (204), Colo. (304), Alta. (304), B. C. (194), Ida. (81), Wash., Ore., Cal. (296), Ariz. (305), Tex. (304), Fla. (337), Ga. (297), N. C. (43), Tenn. (498); Eur. (375); Africa (325).

[80]It was originally reported from between these two towns in Tennessee but as Howe pointed out in 1901 (297), the towns are in Georgia. This makes the original collection in the vicinity of lat. 34° 12′ N., long. 83° 43′ W., in the upper watershed of the Oconee River.

14. **Riccia donnellii**[31] Aust., Bull. Torr. Bot. Club 6:157, 1877.

Thalli large, commonly 10-12 mm long, at first somewhat radiate, becoming irregularly gregarious, subsimple or 1-5 times dichotomous, of a bright clear light green and with a crystalline luster when living, lighter green when dry, concolorous or occasionally brownish below. Upper surface reticulate when dry. Dorsal groove deep, narrow, often abruptly closed in front, soon broadening and commonly disappearing in older parts. Vein carinate, sometimes incrassate toward tip and developing a



Riccia donnellii. 1, Outline of cross section of thallus, x 13. 2, Ventral scale of thallus, x 22. 3, Spore with reticulations, outer face, x 177. 4, Vertical filaments of thallus, (*c*) chamber, x 80. 5, Portion of margin, (*m*) marginal hair, x 31. 6, Thallus, larger than usual, dorsal view, x 2.7. 7, Spore with irregular and anastomosing ridges, outer face, x 177. (All after Haynes.)

descending pedunculate tuber. Margin ciliate, alate, thin, ascending in younger parts, otherwise nearly plane; cilia few to numerous, sometimes gemminate, short, stout, obtuse, 100-325 μ long, 75-150 μ in greatest width. Chief segments linear to shortly oblong, obcordate, 2-7 mm wide; cross section semi-orbicular or parabolic exclusive of the wing, 1-4 times as wide as high including the wing; terminal segments ovate or obcordate to oblong, obtuse to emarginate. Ventral scales rudimentary or inconspicuous. Dorsal epidermis 2-stratose; cells of outer layer subhemispheric or ovoid-ellipsoid, mostly 45-85 μ wide; obtuse or occasionally mammillate, soon collapsing and leaving irregular vestiges; cells of the second layer mostly 75-150 μ wide, commonly wider than high. Thalli unisexual; male thallus often narrow; antheridial ostioles numerous, much elevated, 200-800 μ high. Sporangia usually numerous, 0.75-1 mm in diameter, often crowded in a single or double row. Spores angular, 130-190 μ in longest diameter, somewhat rough, soon black and very opaque; wing-margin 2-6 μ wide, nearly smooth to lightly granulate, the truncate verrucae 2-4 μ high; outer face areolate, in profile smooth or nearly so; areo-

[31]dŏn nĕl' lĭ ī.

lae visible only on the young spores, mostly 10-14 μ wide; inner faces similarly marked but less strongly so. Named in honor of J. Donnell Smith, who first collected it.—On sand in ditches; on soil in gardens and on cattle ranges.

ILLUSTRATIONS: Haynes, Bull. Torr. Bot. Club 47: pl. 10, 1920. EXAMINATIONS: —*Fla.* Sanford (Rapp) 1915, 1917; Jacksonville (Austin) undated.

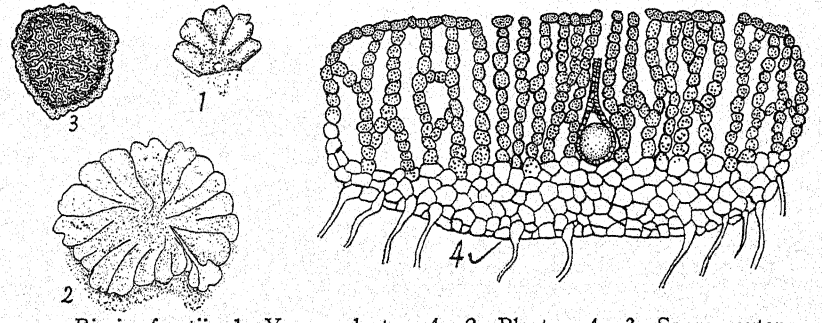
TYPE LOCALITY: Jacksonville, Florida (J. Donnell Smith) Feb. 1877. RANGE: Fla. (266), Tex. (270).

Section *Ricciella.*[32] Photosynthetic layer composed of chambers whose walls are plates one cell thick.

15. **Riccia frostii**[33] Aust., Bull. Torr. Bot. Club 6:17, 1875.

R. watsoni[34] Aust., Bull. Torr. Bot. Club 6:17, 1875.
R. frostii var. *major* Underw., Bot. Gaz. 19:273, 1894.
R. beckeriana[35] Steph., Bull. Herb. Boissier 6:374, 1898.

Thalli small to medium sized, forming compact rosettes 4-15 mm in diameter or at length irregularly gregarious, 2-6 times dichotomous, dark green to grayish green or reddish purple above, the same beneath. Upper



Riccia frostii. 1, Young plant, x 4. 2, Plant, x 4. 3, Spore, outer face, x 240. 4, Cross section of thallus, x 50. (1, 2, after Clark & Frye; 3, 4, after K. Mueller.)

surface obscurely reticulate or substriate when young, soon becoming spongiose or lacunose specially in drying. Dorsal groove usually well defined only at apex. Margin often reddish purple, naked, rounded-obtuse or subacute, commonly plane. Chief segments obovate to linear, 0.5-2 mm wide; cross section 1.5-3 times as wide as high, 14-20 cells high in median region, its ventral outline rather convex; terminal segments obovate to linear, obtuse, obscurely emarginate. Rhizoids with smooth walls. Ven-

[32] rĭk sĭ ĕl' lä.
[33] frôst' ĭ ĭ.
[34] *R. watsoni* Aust. was erected on the male plants of *R. frostii* (512) collected apparently in Nevada although Austin (24) does not give any locality.
[35] *R. beckeriana* was a name given to material collected by Becker in 1853 at Sarepta, Russia (491). Heeg (275) pointed out that this was not distinct from *R. frostii.*

tral scales wanting or very rudimentary. Dorsal epidermis rather indeterminate; the cells of the primary stratum subconic, obtuse or flat-topped, 40-70 μ wide, mostly wider than high, subpersistent or collapsing irregularly. Air chambers sometimes narrow and columnar with occasional transverse or oblique partitions; mostly elongated polyhedral, showing 2-4 vertical series; their walls unistratose. Thalli unisexual; the antheridial ones small, often reddish purple; antheridial ostioles elevated 75-130 μ. Sporangia usually numerous, their covering soon ruptured and exposing the spores. Spores angular, 40-65 μ in longest diameter, brown; wing margin 2-3 μ wide, granulate-crenulate; outer face often becoming mucilaginous, marked with numerous short delicate wavy and rarely anastomosing ridges which in profile appear to be papillae about 1 μ high; median areolae of outer face when present 1.5-3 μ wide; inner faces similar to outer but less strongly marked. First collected by Soreno Watson and the material sent to C. C. Frost; Frost sent it to Austin who named it in his honor.—On silty deposits along rivers.

ILLUSTRATIONS: Hirsh, Bull. Torr. Bot. Club 37:74-76, figs. 5-7, 1910; Black, Ann. Bot. 27: pl. 37-38, 1913; K. Mueller (409) 1: fig. 138; Clark and Frye, Pub. Puget Sound Biol. Sta. 6:7, figs. 1-4, 1929. EXAMINATIONS:—*Wis.* Cedar Grove (Curtis 1336) 1920.—*S. Dak.* Custer (McIntosh) 1925.—*Neb.* Peru (Sheldon) 1900. *Wash.* Wawawai (Piper) 1895; Columbia River Bottom (Frye) undated.—*Ore.* Medford (Wells) 1926; Sand Island (Reed College collection) 1930.—*Cal.* Oakland (Carter 396) 1933; Fair Oaks (Carter 373) 1933.

TYPE LOCALITY: Nevada (S. Watson). RANGE: Vt. (185), N. Y. (364), Ohio (504), Ind. (42), Ill. (529), Wis. (99), Iowa (469), S. Dak. (185), Neb. (204), Colo. (175), Mont. (81), Ida. (81), Wash. (81), Ore. (457), Cal. (305), Nev. (504), N. Mex. (354), Okla. (353), Kan. (364), Mo. (185), Va. (203); Mex. (305); Asia (185); Eur. (364).

Riccia with somewhat columnar air chambers, and *Ricciella* with somewhat isodiametric air chambers are by some authors considered distinct genera. *R. frostii* sometimes has both forms in the same thallus, which thus weakens the argument in favor of a genus *Ricciella.*

16. Riccia curtisii[36] T. P. James, Aust. in Proc. Acad. Nat. Sci. Philadelphia 21 (1869):231, 1870, as synonym.

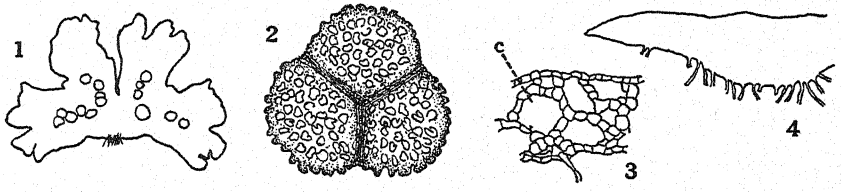
Cryptocarpus[37] *curtisii* Aust., Proc. Acad. Nat. Sci. Phila. 21 (1869):231, 1870.
Thallocarpus curtisii Lindb., Bull. Torr. Bot. Club 6:21, 1875.
Angiocarpus curtisii Trev., Mem. Istit. Lomb. 13:444, 1877.

Thalli small to moderately large, 2-20 mm long, forming rosettes 20-30 mm in diameter, 1-4 times dichotomously branched and flabellately disposed, or occasionally subpinnately dichotomous, light green or yellowish green above, the same below. Upper surface papillose or ridged, soon spongiose or lacunose. Dorsal groove rather wide and indistinct. Mar-

[36]kûr' tĭ sĭ ī.

[37]*Cryptocarpus* has been used in the flowering plants, in Nyctaginaceae; the single species is *C. pyriformis* H. B. K. It was also used in mosses by Dozy & Moelkenboer in Musc. Frond. Ined. Arch. Ind. 37, 1884, for species now referred to *Desmotheca.*

gin naked, often more or less undulate-crisped or crenate in younger parts, unistratose for a width of 1-4 cells. Chief segments oblong or subquadrate, 2-3 or even 4 mm wide; cross section oblong or concavo-convex, subcrescentic or sometimes almost semi-orbicular, mostly 2-4 times as wide as high; terminal segments oblong or subquadrate, rounded-obtuse or subtruncate, commonly emarginate. Rhizoids of two kinds or sometimes all reported to have smooth walls. Ventral scales none or rudi-



Riccia curtisii. 1, Thallus showing location of sporangia, x 2.7. 2, Tetrad of spores, x 205. 3, Portion of cross section of thallus, (*c*) chamber, x 22. 4, Outline of portion of cross section of thallus, x 2.7. (All after Haynes.)

mentary. Dorsal epidermis soon interrupted and rather indeterminate; its cells subpersistent, 50-100 μ in greatest diameter in surface view, or more elongate and sometimes 150-260 μ. Air chambers ovoid or soon long clavate or long polyhedral, in 2-3 vertical series; their walls unistratose; basal tissue mostly of 2-6 layers of cells. Pores 1 or more per chamber, small or large, subelliptical or irregularly polygonal. Thalli unisexual; the antheridial ones usually smaller, often minute, like the female in color and in dorsal surface; antheridial ostioles elevated 75-150 μ. Sporangia 600-800 μ in diameter, included. Spores permanently united in tetrads, 45-65 μ in longest diameter so far as visible in the tetrad, sometimes thickly beset with verruculae or spinules except in the contact sinuses; tetrads 90-130 μ in longest diameter, verruculae obtuse to truncate, 2-3 μ high; spinules subacute to truncate, 3-6 μ high, arising from the angles of a scarcely visible to obvious basal reticulum. Named in honor of Curtis, the original collector.—On rich moist soil; in ditches.

ILLUSTRATIONS: McAllister, Bull. Torr. Bot. Club 43: pl. 4, 1916; Haynes, Bull. Torr. Bot. Club 47: pl. 13, 1920. EXAMINATIONS:—*N. C.* Durham (Bloomquist) 1928. —*Fla.* Sanford (Rapp) 1920; Tallahassee (Allen) 1934.

TYPE LOCALITY: North Carolina (Curtis) 1853. RANGE: N. C. (504), S. C. (504), Fla. (491), Tex. (305).

The most remarkable feature of the species is the union of its spores in tetrads throughout the mature stage as in *Sphaerocarpus.* This is the only member of the Ricciaceae, at least within our territory, possessing this feature, although *Oxymitra* comes close to it. Since neither is very close to the Sphaerocarpaceae the occurrence here decreases the value of this character as an argument for considering Sphaerocarpaceae lower than Ricciaceae. It was undoubtedly chiefly this character which led Austin (21) to erect the genus *Cryptocarpus* upon this species.

17. Riccia membranacea[38] Gottsche & Lindenb., G. L. & N. Syn. Hep. 608, 1846.

R. tenuis Austin, Proc. Acad. Nat. Sci. Philadelphia 21, (1869) :233, 1870.
R. lanigera Spruce, Trans. Bot. Soc. Edinburgh 15 :570, 1885.
Ricciella membranacea Evans, Rhodora 12 :196, 1910.

Thalli rather small, 3-7 mm long, irregularly gregarious, usually 1-2 times dichotomous, usually dark green on both sides, thin and membranous, the younger parts with 1-celled margin 1-5 cells wide. Upper surface smooth or in drying more or less wrinkled. Dorsal groove scarcely manifest except at apex. Vein rather obscure. Chief segments 2-4 mm wide; cross section sublinear to attenuate-elliptical, 8-12 times as wide as high, the upper line straight, the lower convex; terminal segments obovate to obcordate or suborbicular, retuse or emarginate to bifid. Ventral scales wanting or rudimentary. Dorsal epidermis unistratose, persistent, its cells mostly 50-65 μ in maximum diameter in surface view, or more elongate and sometimes 100-104 μ, close fitting. Air chambers large, irregularly polyhedral, in 1-2 series vertically; their walls unistratose; basal tissue mostly of 1-3 layers of cells. Pores occasional, large, irregular, often subelliptic, above the air chambers. Thalli bisexual; antheridial ostioles elevated 50-160 μ. Sporangia moderately numerous, 350-480 μ in diameter, protuberant on the lower surface. Spores ovoid or ellipsoid to subglobose or sometimes obscurely angled, 40-65 μ in longest diameter, spinose; spines numerous, truncate or obtuse to subacute, 2-3 μ long, brown; wing margin wanting; median areolae of outer surface none; inner faces also spiny, not areolate. So named from its thin membranous thallus.—On wet ground in open woods.

ILLUSTRATIONS: None. EXAMINATIONS:—*Conn.* Hartford (Lorenz 3014) 1914. —*Ky.* Murray (Wolfson) 1934.

TYPE LOCALITY: Mexico. RANGE: Conn. (305), N. J. (21), Del. (512), Ohio (512), Mo. (504), Okla. (354), N. Mex. (272), Ark. (512), La. (305), Ky., N. C. (43); Mex. (491); West Indies (305); S. Amer. (38).

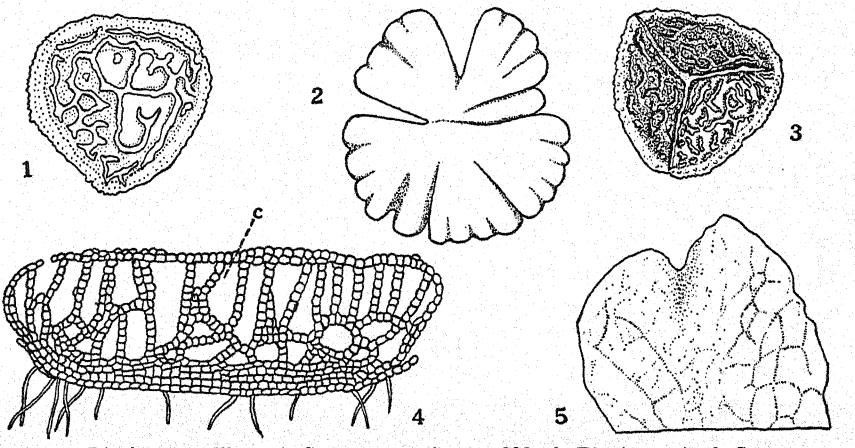
We have seen only dried material.

18. Riccia crystallina[39] L. Sp. Pl. 1138, 1753.

R. catalinae[40] Underw., Bot. Gaz. 19 :275, 1894.
R. brandegei[41] Underw., Bot. Gaz. 19 :275, 1894.
Ricciella crystallina Warnst.[42] Krypt.-Fl. Mark Brandenburg 1 :80, 1902.

[38] měm brān ā′ sē ä.
[39] krȳs tăl′ lĭ nä.
[40] Howe considered this a distinct species in 1899 (296) separated from *R. crystallina* by (*a*) the thinner thallus of the former, thus the segments wider for their thickness; (*b*) the less distinctly areolate spores; and (*c*) the wider areolae of the faces of the spores. He stated he was unable to get satisfactory cross sections from the dry material. Later, in 1923 (305) he merged it with *R. crystallina*.
[41] Stephani's accrediting of *R. brandegei* to California is a geographical error. It was known only from the southern extremity of Lower California when he wrote. It must be confusing to those not familiar with our geography that southern California is a part of California and Lower California is a part of Mexico. T. S. Brandegee collected it in 1898. It was larger than the normal *R. crystallina* and the spores were rather larger.
[42] Warnstorf credits Stephani with this combination but Stephani merely used *Ricciella* as a subgenus under *Riccia*.

Thalli small to moderately large, forming rosettes 5-30 mm in diameter or soon irregularly gregarious, 2-6 times dichotomous, usually light crystalline green or often yellowish green above, occasionally dark green and then tinged with reddish purple or brownish red, the under side the same color as the upper; upper surface vesicular-alveolate, soon becoming spongiose or lacunose-alveolate especially in drying. Dorsal groove usually rather poorly defined except at apex. Vein projecting below. Mar-



Riccia crystallina. 1, Spore, outer face, x 202. 2, Thallus, x 1. 3, Spore, inner face, x 202. 4, Cross section of thallus, (*c*) chamber, x 16.7. 5, Portion of thallus, dorsal view, showing internal plates of cells which bound the air chambers, x 15.3. (2, 4, after Casares-Gil; the others after Howe.)

gin sometimes reddish purple or brownish red, naked, obtuse or subacute. Chief segments subquadrate-obovate to obcuneate-oblong or oblong-linear, 1-2.5 mm wide; cross section subelliptical to somewhat parabolic, 2-4 times as wide as thick, the ventral outline convex or nearly straight; terminal segments subquadrate-obovate or obcordate, obtuse or subtruncate, emarginate. Ventral scales wanting or rudimentary. Dorsal epidermis soon indeterminate; the cells of the primary stratum subspherical to ellipsoidal or papilliform, irregularly collapsing or subpersistent, they or their successors finally 40-110 μ in longest diameter. Air chambers elongated polyhedral, showing 2-4 series in vertical section; their walls 1-cell thick. Thalli unisexual, possibly rarely bisexual; antheridial ostioles elevated 75-250 μ. Sporangia moderately numerous, often rather long included. Spores distinctly angular, 60-110 μ in diameter, at first yellowish but soon dark and often nearly opaque; wing margin mostly 3-10 μ wide, granulate-papillate, often crenulate-cristulate; outer face areolate; areolae imperfect, up to 30-45 μ in diameter, enclosing a free-ending spur or an isolated tubercle; inner faces with tubercles or with short free irregular

ridges, sometimes with imperfect areolae. Named from its usually light crystalline green color. However, other species, for example *R. trichocarpa,* also have this color.—Along the banks of streams, and on damp soil elsewhere.

ILLUSTRATIONS: Bischoff, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 18: pl. 22, 1836; Howe, Mem. Torr. Bot. Club 7: pl. 91, figs. 16-20, 1899; Leitgeb, Unters. Leberm. 4: pl. 1, figs. 5-8, pl. 2, figs. 7-9, 1881; Pearson (433), pl. 217; Warnstorf (523) 1:79, fig. 6; Macvicar (374) 26, figs. 1-3; K. Mueller (409) 1: fig. 137; Gil (76) fig. 135. EXAMINATIONS:—*Mass.* Cheshire (Lorenz) 1914.—*N. Y.* Ithaca (Atkinson) undated.—*Fla.* Sanford (Rapp) 1918.—*Colo.* Colorado Springs (Haynes 15070) 1912.—*Wyo.* Dubois (Clayton 732) 1930.—*Mont.* Gallatin River (Jennison) 1927.—*Alta.* Dowling Lake (Brinkman) 1915.—*Ida.* Winchester (Miller) 1934.—*Ore.* Warner Lakes (Rakestraw) 1936.—*Cal.* Helmet Butte (Munz 5140) 1922; Mt. Hamilton Range in Santa Clara County (Carter 631) 1934.

TYPE LOCALITY: Florence, Italy. RANGE: Vt. (305), Mass. (203), Conn. (212), N. Y., Ill. (506), Wis. (99), Colo. (175), Wyo. (84), Mont. (84), Alta. (305), B. C. (84), Ida. (508), Ore. (81), Cal. (296), Nev. (504), Tex. (305), Fla. (266), S. C. (512); Mex. (512); West Indies (160); Asia (387); Eur. (374).

Riccia crystallina was not always distinguished in this country from *R. frostii.* For this reason some of the early reports of *R. crystallina* are somewhat in doubt.

19. **Riccia sullivantii**[48] Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869): 233, 1870.

R. fluitans terrestris Aust. Hep. Bor-Amer. Exsic. No. 37, 1874.
R. fluitans sullivantii Underw., Bull. Ill. State Lab. Nat. Hist. 2:28, 1884.
R. huebeneriana of Underw., Bot. Gaz. 19:276, 1894; not *R. huebeneriana* Lindenb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 18:504, 1836.
Ricciella sullivantii Evans, Rhodora 9:56, 1907.

Thalli in rosettes 10-20 mm in diameter or irregularly gregarious, mostly 3-5 times dichotomously branched and the branches often widely spreading, light green to dark green both above and below, or rarely somewhat purplish beneath and along the margins. Upper surface smooth or with age sometimes spongiose-alveolate. Dorsal groove wide and rather shallow, usually well defined. Margins obtuse or subacute, usually ascending. Chief segments oblong or sublinear to subcuneate-quadrate, 0.75-1.5 mm wide; cross section subelliptical or fusiform, mostly 2-4 times as wide as high; terminal segments oblong to elliptical or quadrate-obovate, obtuse to emarginate. Ventral scales rudimentary. Dorsal epidermis unistratose, persistent or with age sometimes becoming mucilaginous and disintegrating over the air chambers, its cells mostly 50-120 μ in longest diameter. Air chambers polyhedral or clavate, in 1-3 series vertically; their walls unistratose. Thalli bisexual; antheridial ostioles elevated 100-175 μ. Sporangia usually numerous, showing as hemispheric or subglobose swellings 500-750 μ in diameter on the ventral surface. Spores angular, 50-78 μ in longest diameter, yellowish brown to brown; wing margin 0-6 μ wide, often cut into crests or papillae; outer face areolate; areolae

[48] sŭl lĭ văn' tĭ ī.

8-13 μ wide, 1/8-1/5 the width of the face, the corners of the meshes from scarcely elevated to papillose elevated; the papillae up to 3 μ high, obtuse or truncate, nearly smooth to cristulate-muriculate; inner faces similar to the outer, less distinctly and sometimes less perfectly areolate. Named in honor of W. S. Sullivant.—On damp ground in cultivated fields or margins of ponds.

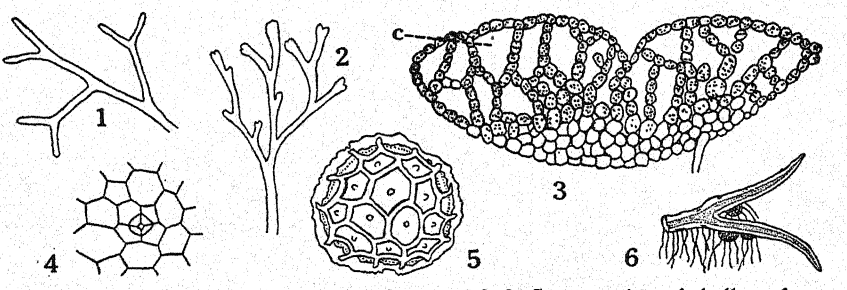
ILLUSTRATIONS: None. EXAMINATIONS:—*Me.* Cumberland (Chamberlain) 1901; Canton (Parlin) 1928.—*N. H.* Cornish (Haynes) 1906.—*Mass.* Wakefield (Kingman) 1908.—*Conn.* Milford (Lorenz 501) 1908; Salem (Lorenz) 1923.—*N. Y.* Orient (Latham 50) 1919.—*Pa.* South Haven (Knout) 1911; *W. Va.* Morgantown (Ammons 220) 1930.—*N. C.* Asheville (Schallert) 1923; Durham (Bloomquist 149) 1931.

TYPE LOCALITY: Closter, New Jersey. RANGE: Me. (99), N. H. (155), Vt. (140), Mass. (235), R. I. (203), Conn. (169), N. Y. (364), Que. (338), Pa. (338), Ont. (373), Ohio (512), Ill. (529), Wis. (338), Mo. (338), Ark. (46), Fla. (337), Ky. (218), N. C. (43), Va. (212), Md. (444), N. J. (364); West Indies (338); Asia (512); Eur. (422).

20. Riccia fluitans[44] L. Sp. Pl. 1139, 1753.

R. canaliculata Hoffm. Deutsch. Fl. 2:96, 1795.
R. fluitans canaliculata Roth Fl. Germ. 3 (1):434, 1800.
Ricciella fluitans A. Br., Flora 4:757, 1821.
R. nodosa Boucher Fl. d'Abbeville, Ed. 3, 88, 1834.
R. eudichotoma Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17:1068, pl. 70, fig. V (1-7), 1835.
R. oerstediana Lindb. & Hampe, Linnaea 24: 1851.
R. stenophylla Spruce, Bull. Soc. France 36:cxcv, 1889.

Thalli 1-5 cm long, band-like, repeatedly and regularly dichotomous, green on both sides. Upper surface smooth, often wrinkled when dry,



Riccia fluitans. 1, 2, Floating plants, x 2.3. 3, Cross section of thallus of land form, (*c*) chamber, x 50. 4, Pore of land form, x 175. 5, Spore, outer face, x 180. 6, Portion of fertile thallus of land form. (4, after Leitgeb; 1, 2, after Meylan; 3, 6, after K. Mueller.)

sometimes with shallow pits when old. Dorsal groove shallow, present only near apex in water forms, extending variously back in stranded forms. Vein projecting on the under side. Margin 1-3 cells thick, naked, mostly plane in water forms, ascending in land forms. Chief segments

[44] flū' ĭ tăns.

narrowly linear, 0.5-1.5 mm wide; cross section often biconvex, mostly 2-4 times as wide as thick, 1-3 cells high near margin; terminal segments oblong to linear, obtuse to emarginate. Rhizoids rare on aquatic forms, moderately common on land forms, colorless or violet. Ventral scales none or in land forms rudimentary, colorless to violet. Dorsal epidermis unistratose, persistent, with age sometimes becoming gelatinous and disintegrating over the air chambers; its cells in land forms mostly 40-90 μ in longest diameter, in water forms 50-100 μ. Air chambers long polyhedral, large, in 1-3 series vertically; their walls unistratose. Pores minute in land forms, wanting in water forms. Thalli bisexual; antheridial ostioles elevated 75-150 μ. Sporangia limited to stranded or land forms, apparent on the under surface as hemispheric or globose swellings 450-600 μ in diameter. Spores angular, 65-104 μ in diameter, yellowish brown, translucent; wing margins 3-8 μ wide; outer face areolate; areolae rather smooth, 12-25 μ wide, 1/4 to 1/5 the width of the face, the larger often enclosing a free ending spur or an isolated tubercle; inner faces with short ridges, these either free or irregularly anastomosing. Name from L. *fluitans,* floating; because it commonly grows suspended or floating in fresh water, or stranded to terrestrial on moist soil.

ILLUSTRATIONS: Bischoff, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17: pl. 70, fig. 5, 1835, and 18: pl. 24-25, 1836; Leitgeb, Unters. Leberm. 4: pl. 1, figs. 1-13, 1881; Pearson (433) pl. 224; K. Mueller (409) 1: fig. 6, 134; Macvicar (374) 28, figs. 1-4; Warnstorf (523) 1:79, fig. 8; Meylan (386) fig. 19. EXAMINATIONS:—*Me.* Canton (Conklin 9411) 1930.—*N. H.* Sanbornton (L. Carter) 1901.—*Vt.* Castleton (Dutton) 1909.—*Mass.* East Gloucester (Greenwood) 1908.—*Conn.* Central Village (Sheldon) 1900.—*N. Y.* Greenport (Latham 1528) 1923.—*Md.* Cabin John (Chamberlain 1275) 1903.—*Ohio.* Northfield (Fulford) 1929.—*Ind.* Miller (Umback) 1898.—*Mich.* Bedford (Conklin 268) 1907.—*Wis.* Superior (Conklin 1217) 1911.—*Minn.* Lamailli (Holzinger) 1902.—*Iowa.* High Lake (collector ?) 1915.—*Mo.* Purdy (Dometres) 1897.—*S. Dak.* Hot Springs (McIntosh) 1928.— *Utah.* Utah Lake (Garrett) (year ?).—*Wash.* Seattle (Rigg) 1926.—*Cal.* Marin County (Sutliffe) 1928.—*Ariz.* Sabin Canyon (Eastwood) (year ?).—*La.* New Orleans (Taylor) 1924.—*Fla.* Sanford (Rapp) 1911.—*N. C.* Williamstown (Bloomquist) 1932.

TYPE LOCALITY: European. RANGE: Me. (203), N. H. (203), Vt. (140), Mass. (169), R. I. (169), Conn. (212), N. Y. (338), Que. (178), Pa. (338), Ont. (373), Ohio, Ind. (441), Mich., Ill. (529), Wis. (98), Minn., Iowa (528), S. Dak., Mo., Colo.[45] (175), Utah, B. C. (508), Wash. (81), Ore. (81), Nev. (296), Cal. (81), Ariz. (202), Tex. (354), Okla. (354), La. (95), Ala. (396), Fla. (337), N. C. (43), Ky. (218), W. Va. (468), Va. (332), Md., D. C. (343); West Indies (305); Mex. (224); S. Amer. (38); Samoa (491); N. Z. (212); Borneo (221); Asia (387); Eur. (325); Africa (212).

RICCIOCARPUS[46] Corda, Opiz, Beitr. 651, 1829.

Thalli floating or stranded and sometimes on mere wet soil; basal and costal tissue much reduced, usually consisting of only a few layers of cells. Aquatic forms little branched, with few or no rhizoids, with numer-

[45]So far as we know, the report of its occurrence in Colorado rests upon a collection by J. Wolf in 1873. It is a species easily recognized but has not been found there since; thus there is some doubt of its occurrence.

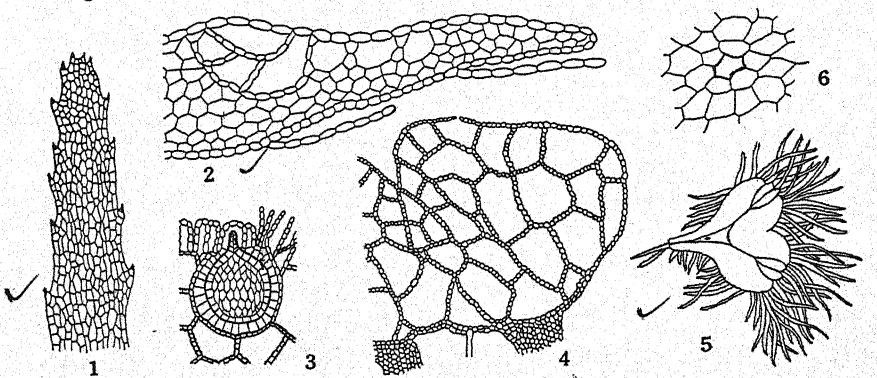
[46]rĭk″ sĭ ō kär′ pŭs.

ous ventral scales; the scales pendant, conspicuous, linear or linear-lanceolate, dentate, reddish violet or brownish green. Stranded or land forms more branched, with small or rudimentary scales, with numerous rhizoids of both the smooth form and that with inner peg-like thickenings. Upper surface areolate through the visibility of the chambers beneath. Dorsal groove narrow and conspicuous. Dorsal epidermis of one layer of cells, persistent, compact, continuous except for the pores. Air chambers large, polyhedral, in several vertical series, their walls unistratose. Pores 1 per superficial chamber; cells bordering it 5-6, little differentiated, elevated and more differentiated in the land forms. Thalli bisexual but the antheridia forming before the archegonia; antheridia in an elongated ridge in the dorsal groove; antheridial ostioles slightly elevated; archegonia forming later, in the same furrow or on a new lobe, without special involucres, their walls of 2 layers of cells or the inner disintegrating with age. Sporangium wall unistratose, finally disintegrating, remaining within the distended archegonium. Spores separating at or before maturity; all the cells within the wall of the sporangium producing spores.

1. **Ricciocarpus natans**[47] (L.) Corda, Opiz, Beitr. 651, 1829.

Riccia natans L. Syst. Nat., Ed. 10, 1339, 1759.
Riccia capillata Schmidel Icon. Pl. 276, pl. 74, 1797.
Riccia lutescens Schweinitz Specim. Fl. Amer. Sept. 26, 1821.
Riccia velutina Wils., Hooker Icon. Pl. pl. 249, 1849.
R. velutinus Steph., Bull. Herb. Boissier 6:758, 1898.

Thalli obtuse to cordate. Floating thalli obcordate or flabelliform, mostly 4-10 mm long and 4-9 mm wide, dark green, often the under side orange or violet. Land thalli forming rosettes 23-35 mm in diameter, or



Ricciocarpus natans. 1, End of ventral scale, x 32. 2, Cross section of part of thallus, x about 30. 3, Archegonium containing young sporophyte, x about 18. 4, Cross section of water form, x 28. 5, Plant, water form, with many ventral scales, x 1. 6, Pore of thallus, x 120. (1, 4, 6, after K. Mueller; the others after Pearson.)

[47] nā′ tăns.

irregularly gregarious; their chief segments oblong to obovate or cuneate, mostly 2-4 mm wide. Upper surface distinctly reticulate on account of the air chambers visible through it. Margin acute, becoming more obtuse and bullate-undulate in land forms, often violet or brownish. Sporangia slightly protuberant above, crowded in 1-3 series along the median line, occurring rather infrequently and chiefly in early summer in temporary pools. Spores angular, 42-57 μ in longest diameter, dark brown at maturity; wing margin narrow, obscurely dentate; outer face papillate-areolate; areolae poorly defined, mostly 7-8 μ wide, obscure with age; papillae numerous, obtuse to truncate, 1-4 μ long; inner faces almost like the others. Name from L. *natans,* floating; from its usual habitat.—Floating, stranded or on wet soil.

ILLUSTRATIONS: Schmidel, Icon. Pl. pl. 74, 1797; Bischoff, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17: pl. 71, fig. V, 1835; Lindenberg, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 18: pls. 26, 31, 32, 1836; Leitgeb, Unters. Leberm. 4: pl. 2, figs. 13-23, 1881; Warnstorf (523) 1:84, figs. a-d; Pearson (433) pl. 225; K. Mueller (409) 1: fig. 7, 139; Garber, Bot. Gaz. 37: pl. 9-10 and figs. 1-4, 1904; Macvicar (374) 30, figs. 1-3; Lewis, Bot. Gaz. 41: pls. 5-9, 1906. EXAMINATIONS:—*Vt.* Brandon (Dutton) 1910.—*Mass.* Worcester (Greenwood) 1908.—*Conn.* Milford (Lorenz) 1908.—*R. I.* East Providence (Green) 1887.—*N. Y.* White Plains (Underwood) 1897.—*Que.* Montreal (Dupret) 1912.—*Ohio.* West Jefferson (Taylor) 1922.—*Ind.* East Chicago (Hill)1901.—*Ill.* Calumet River (Dudley) (year ?).—*Mich.* Bedford (Conklin) 1907.—*Wis.* Madison (Cheney) 1892.—*Minn.* Winona (Holzinger) 1912.—*Iowa.* High Lake (Conklin) 1915.—*Mo.* Valley Park (Nelson 15801) 1907.—*Wash.* Friday Harbor (Clark) 1925.—*Cal.* Santa Clara (Bradshaw 3098) 1923.

TYPE LOCALITY: Hadley, Suffolk, England. RANGE: Me. (140), N. H. (169), Vt. (203), Mass. (461), R. I. (140), Conn. (212), N. Y. (60), Que. (178), Pa. (338), Ont. (373), Ohio (496), Ind. (441), Ill. (20), Wis. (98), Minn. (512), Iowa (469), Mo. (496), Neb. (204), B. C. (212), Ida. (512), Wash. (81), Ore. (457), Cal. (310), Tex. (496), La. (396), Ala. (396), Fla. (337), N. C. (43), Ky. (218), Tenn. (464), Va. (512), D. C. (343), N. J. (21); West Indies (338); Mex. (212); S. Amer. (461); Australia (461); N. Z. (461); Asia (212); Eur. (374).

OXYMITRA[48] Bisch., Lindenb. Syn. Hep. Eur. 124, 1829.

Tessellina Dum. Comm. Bot. 78, 1822, in part.
Rupinia Corda, Opiz, Beitr. 650, 1829; not of L. f. Suppl. 69, 1781.
Pycnoscenus Lindb., Oefv. Svensk. Vet.-Akad. Foerh. 19:606, 1863.

Thalli on soil. Ventral scales usually large and conspicuous. Dorsal epidermis persistent. Air chambers large, subvertical, 4-7-angled, prismatic or pyramidal, their walls unistratose. Pores well developed, simple, stellate. Thalli unisexual or bisexual. When unisexual the antheridia grouped in receptacles; these receptacles well defined, sessile, median, bordered, often more or less covered with articulate hairs or cilia, with elevated cylindric or conic-cylindric ostioles. When bisexual the antheridia in individual involucres; these involucres flask-shaped, essentially free; archegonia along dorsal groove, in individual involucres, mostly of 1 layer

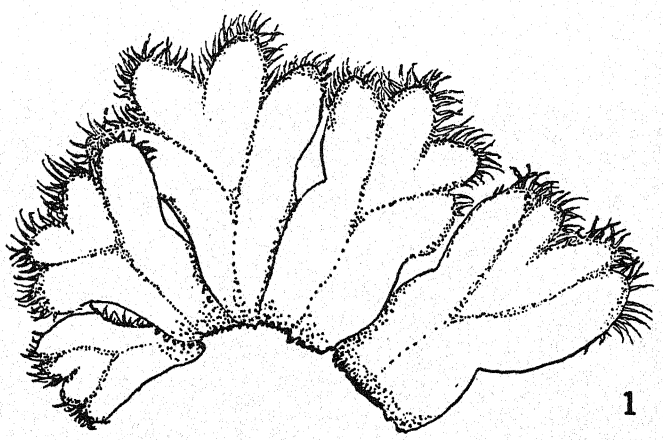
[48] ὄx ỹ' mĭt rä. *Oxymitra* was used in the Anonaceae in 1829 for a subgeneric section by Blume, and for a genus in 1855.

of cells when mature; these involucres provided with air chambers and pores, becoming large after fertilization. Sporangia without stalk or foot, covered by the calyptra and by the involucre; wall of sporangium 1 cell thick, sometimes 2 cells thick at apex, often 2-3 cells at base; mature involucre persistent, exserted, conical to trigonal, pointed to subrostrate at tip. Spores separating at or before maturity, young spores with traces of sterile cells among them.—Apparently so named from the sharply pointed involucre covering the mature sporangium; Gk. *oxys,* sharp, and *mitra,* a hollowed cap-like organ.

1. **Oxymitra androgyna**[49] **M. A. Howe, Bryologist 17:93, 1914.**

O. paleacea of Howe, Bryologist 17:74, 1914; not of Bisch., in Lindenberg's Syn. Hep. Eur. 124, 1829.

Thalli mostly 8-18 mm long, loosely gregarious or closely aggregated in more or less rosette-like masses, glaucous green beneath, pale green or brownish purple, 1-3 times dichotomous. Upper surface finely areolate.



Oxymitra androgyna. 1, Plant, x 3. (After Howe.)

Dorsal groove deep, acute, narrow, sharply defined. Margin subacute, ascending to slightly recurved, often connivent on drying. Chief segments oblong to quadrate-oblong or subovate, 4-7 mm wide, 2-3 mm thick; cross section subquadrate, 1-2 times as wide as high, rarely higher than wide, 1/3-1/2 the thickness occupied by the photosynthetic layer. Terminal segments quadrate-obovate or obcordate, obtuse to emarginate. Ventral scales hyaline throughout or reddish brown at base, projecting far beyond the margin, 2-4 mm long, conspicuous, numerous, lanceolate or ovate, long-acuminate to filiform-acuminate. Dorsal epidermis of cells

[49] ăn drŏg' y nä.

26-50 μ wide, mostly wider than high; pores distinct; their radiating walls strongly thickened, ovoid or dome-shaped to lanceolate-acuminate in surface view. Thalli bisexual although both sex organs not always found on a thallus; antheridia and archegonia intermingled among articulate hairs and filiform scales on the bottom of the dorsal groove, or the antheridia somewhat inclined to be lateral to the archegonia; antheridial ostioles cylindric or conic-cylindric, elevated 500-700 μ, 85-100 μ wide, decolorate or light brown; mature archegonial involucre rostrate, obscurely triangular-pyramidal to conic-cylindric or cupulate-ovoid, 1.1-2.0 mm high, 0.8-1 mm wide, lightly 8-12-ribbed. Spores angular, 125-175 μ in longest diameter, very dark and opaque when old; outer face areolate, in profile with few verrucae; areolae 24-35 μ wide, verrucae 2-5 μ high; inner faces smooth. Name from Gk. *andre,* man, and *gyne,* woman; in reference to the bisexual thalli. Habitat not stated, but from the nature of the plant it must grow on damp ground.

ILLUSTRATIONS: Howe, Bryologist 17:72, fig. 1, 1914. EXAMINATIONS:—*Tex.* Austin (Young) 1914.

TYPE LOCALITY: Near Austin, Texas (Dr. M. S. Young) Feb. 1914. RANGE: Tex. (303), Okla. (354).

There is only one other species, *O. pyramidata,* of Europe, northern Africa and S. America. The two species differ chiefly in that *O. pyramidata* has (*a*) thalli unisexual, (*b*) the thickened walls radiating from the pores lanceolate in surface view, and (*c*) the spores 100-120 μ in diameter; while *O. androgyna* has (*a*) thalli bisexual or at least mostly so, (*b*) the thickened walls radiating from the pores usually wider as seen in surface view, and (*c*) the spores 125-175 μ in diameter.

MARCHANTIACEAE[50]

Plants thalloid, thin or fleshy, branching dichotomously, often also ventrally or apically. Thalli differentiated into an upper photosynthetic layer and a ventral tissue with no intercellular spaces. Some rhizoids with peg-like thickenings present and also smooth ones. Ventral scales present, usually in 2 or more longitudinal rows. Air chambers well developed (except *Dumortiera*), in 1 or more layers. Pores present (wanting in *Dumortiera*), simple or barrel-shaped. Antheridia and archegonia clustered or rarely scattered, the clusters sometimes elevated on stalks. Involucre nearly always present. Sporophyte consisting of sporangium with stalk and foot. Sporangium wall 1 layer of cells thick except near tip. Dehiscence by valves or rather poorly defined lid, or irregular *(Corsinia).* Sterile cells present among the spores, as elaters (except in *Corsinia*). Spores freed by the rupture of the sporangium wall.

[50]mär shăn″ shĭ ā′ sē ē. We have followed rather closely the work of Dr. A. W. Evans on the group in N. Amer. Fl. 14:29-66, 1923.

A. Thallus with simple pores.
  B. Epidermis of upper surface of thallus with trigones so large that in surface view they bulge into the cells; female and male receptacles sessile; air chambers with or without green filaments..... *Targionia*, p. 47
  BB. Epidermis without trigones large enough to bulge into the cells (except *Reboulia* in which the cells about the pores are in radial rows of 4-5 cells each).
    C. Ventral scales rudimentary; female and male receptacles sessile; air chambers with or without green filaments. *Corsinia*, p. 46
    CC. Ventral scales well formed; female receptacles stalked but male ones sessile; air chambers without green filaments.
      D. Radial walls about the pores quite thickened so the pores are distinctly star-like in appearance.
        E. Ventral scales without appendages.
          F. Air chambers in 1 layer; stalk of the female receptacle without rhizoid furrow..... *Clevea*, p. 50
          FF. Air chambers apparently in more than 1 layer; stalk of the female receptacle with 1 rhizoid furrow..... *Sauteria*, p. 52
        EE. Ventral scales with 1-2 appendages; stalk of the female receptacle with 2 rhizoid furrows..... *Peltolepis*, p. 53
      DD. Radial walls about the pores not much more thickened than the others so the pores are not distinctly star-like in appearance.
        G. Air chambers apparently in more than one layer through the formation of supplementary partitions, without green filaments.
          H. Stalk of the receptacle without rhizoid furrow..... *Plagiochasma*, p. 55
          HH. Stalk of the receptacle with 1 rhizoid furrow.
            I. Pseudoperianth wanting.
              J. Radial rows of 2-3 cells about the pores; female receptacles not or shortly lobed; lid of the sporangium remaining intact.
                K. Involucre undivided; thalli unisexual or bisexual; the antheridial receptacles on separate branches or plants, in scattered groups or well concentrated..... *Mannia*, p. 60
                KK. Involucre 2-lipped; thalli bisexual; the antheridial receptacles behind the female ones, long and narrow..... *Cryptomitrium*, p. 68
              JJ. Radial rows of 4-5 cells about the pores; female receptacle distinctly lobed; lid of the sporangium falling away in fragments; involucre 2-lipped..... *Reboulia*, p. 83
            II. Pseudoperianth present as a white or purplish inflated tube, contracted at mouth, soon longitudinally split into narrow segments which usually remain attached at their tips. *Asterella*, p. 69
        GG. Air chambers in 1 layer, containing green filaments.
          L. End cells of the green filaments under the pores colorless, elongate; ventral tissue without pitted walls, mucilage cells wanting; female receptacle rotate, without pores, its stalk without rhizoid furrow; crescentic gemmae-cups often present..... *Lunularia*, p. 86
          LL. End cells of the green filaments under the pores like the others; ventral tissue with pitted walls, mucilage cells present; female receptacle conic, with pores, its stalk with 1 rhizoid furrow; gemmae-cups wanting..... *Conocephalum*, p. 88

AA. Thallus without pores or air chambers..... *Dumortiera*, p. 90
AAA. Thallus with barrel-shaped pores.
M. Air chambers without green filaments, apparently in 2 layers..... *Bucegia*, p. 93
MM. Air chambers containing green filaments, in 1 layer.
N. Ventral scales in 2 rows; thallus with apical innovations; gemmae wanting; female disk 3-4-lobed, the lobes 1-2 mm long when mature; stalk of female and of male receptacle without green tissue..... *Preissia*, p. 95
NN. Ventral scales in 4 or more rows; thallus without apical innovations; gemmae often present, in circular cups; female disk 5-11-lobed, the lobes 3-5 mm long when mature; stalk of female and sometimes of male receptacle with 1 or 2 bands of green tissue..... *Marchantia*, p. 97

Relationships within the Marchantiaceae

The diagram on page 45 shows the concept of the relationships among North American Marchantiaceae and some of the more important advances. The letters below refer to those on the diagram, and under each are mentioned other changes which took place at the respective points on the diagram:

(A) Green filaments sometimes occur in the chambers but the habit is not yet fixed; male and female organs grouped into rather definite and separate sessile receptacles; involucre either none or an irregular outgrowth; ventral scales irregularly scattered. Sporangium with foot and stalk, irregularly dehiscent; sterile mother-cells always present but always without spirals.

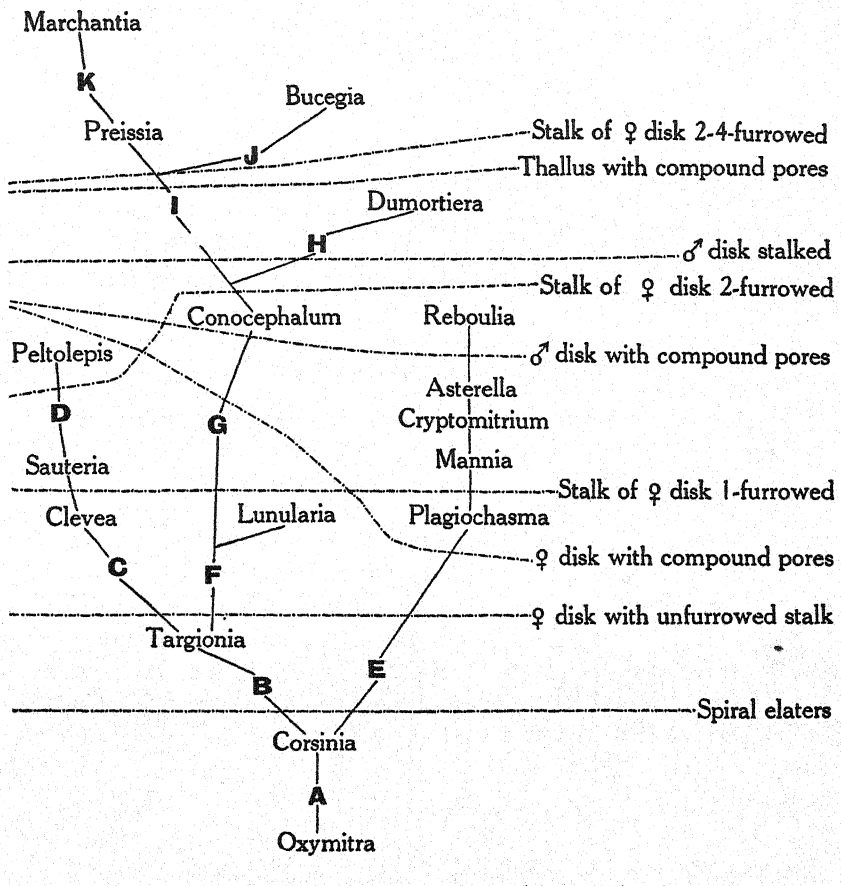
(B) Ventral scales in 2 rows; involucre present. Sporangium with annular or C-shaped thickening in the wall cells, dehiscent by valves; some of the spore mother-cells becoming spiral elaters.

(C) Disappearance of the green filaments in the air chambers; stalk of the female receptable without green tissue; ventral scales in 4 or more rows.

(D) Ventral scales in only 2 rows.

(E) Air chambers with supplementary partitions, resulting in more chambers than pores; ventral scales in 2 rows. Wall cells of the sporangium without spiral or C-shaped thickenings; dehiscence by a lid; some of the spore mother-cells becoming spiral elaters.

(F) Air chambers always with green filaments; stalk of the female receptacle without green tissue. Wall cells of sporangium without annular or C-shaped thickenings.



Philogenetic diagram of the North American Marchantiaceae.

(G) Wall cells of the sporangium with annular or semiannular thickenings.

(H) Epidermal pores wanting throughout; air chambers wanting or rudimentary; epidermal cells of upper surface green.

(I) Pseudoperianth present.

(J) Air chambers without green filaments, apparently in 2-3 layers.

(K) Stalk of the female receptacle with green tissue; ventral scales in 4 or more rows.

CORSINIA[51] Raddi, Opusc. Sci. Bologna 2:354, 1818.

Guentheria Trev., Jahrb. Gewaechsk. 1 (3) :10, 1820.
Tessellina Dum. Comm. Bot. 78, 1822.
Brissocarpus Bisch., Lindenb. in Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14: Suppl. 123, 1829.

Thalli perennial, of medium size, rather firm in texture, sparingly dichotomous, rarely without apical innovations, yellowish to bright green, without purplish color. Gemmae none. Upper surface more or less clearly reticulate through the visibility of the walls of the air chambers. Ventral scales colorless, irregularly scattered, ovate to lunate, gradually narrowed into a filamentous appendage, entire. Dorsal epidermis of one layer of cells, thin walled, without trigones. Air chambers large, mostly in 1 layer; green filaments wanting or short, simple, ending well below the epidermis. Pores simple, surrounded by 1-2 circles of modified cells; these cells thin walled, merely somewhat smaller than the epidermal cells. Ventral tissue well developed, parenchymatous, uniform, thin walled. Thalli usually unisexual, rarely bisexual with the sex organs in separate groups. Antheridia in receptacles; receptacles elongate, sometimes forked, sessile, bordered on each side by a low ridge. Archegonia in a dorsal cluster on an ordinary branch. Involucre none, or when present an irregular outgrowth, lobed, laterally or peltately attached. Calyptra fleshy, coarsely tuberculate. Sporophyte consisting of sporangium with seta and foot. Seta very short; foot bulbous. Sporangium without thickenings in the wall, containing also sterile cells; these sterile cells oval to shortly spindle-shaped, without thickenings. Spores indistinctly tetrahedral. Named in honor of Thomas Corsini, an Italian botanist.

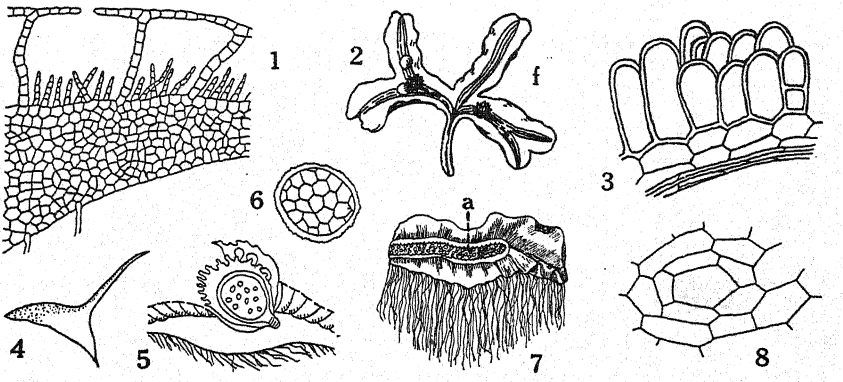
1. **Corsinia coriandrina**[52] (Spreng.) Lindb. Hep. Utveckl. 30, 1877.

Riccia reticulata of J. F. Gmel. Syst. Nat. 2:1355, 1791; not of Sw. Fl. Ind. Occ. Prodr. 146, 1797-1806.
Riccia coriandrina Spreng. Anleit. 3:320, 1804.
C. marchantioides Raddi, Opusc. Sci. Bologna 2:354, 1818.
Guentheria graveolens Trev., Jahrb. Gewaechsk. 1 (3) :10, 1820.
Tessellina coriandrina Dum. Comm. Bot. 78, 1822.
Brissocarpus riccioides Bisch., Lindenb. in Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14: Suppl. 123, 1829.
C. marchantioides var. *gymnocarpa* Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17:1045, 1835.
C. marchantioides var. *involucrata* Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17:1046, 1835.
C. reticulata Dum. Hep. Eur. 166, 1874.

Thalli mostly 2-4 cm long, 5-6 mm wide, plane above except for dorsal groove and wavy margins, under side with broad rounded keel. Dorsal epidermis of cells about 30 x 50 μ. Walls of air chambers 1 cell thick;

[51] kôr sĭ' nĭ ă.
[52] kōr" ĭ ăn drī' nă.

their cells often somewhat thickened near the epidermal cells and often with trigones. Pores slightly elevated, the bounding cells often breaking down with age leaving irregular openings into the air chambers. Sterile cells within the sporangium colorless or pale brown. Spores mostly 100-



Corsinia coriandrina. 1, Cross section of part of thallus, x 25. 2, Female thallus, (*f*) female receptacle, x 1.5. 3, Part of wall of calyptra from mature sporangium, x 85. 4, Ventral scale of thallus, x 20. 5, Longitudinal section of sporophyte on thallus, x 50. 6, Spore, outer face, x 125. 7, Antheridial plant, (*a*) the elongate antheridial receptacle, x 1.5. 8, Pore of thallus, x 245. (4, 5, 6, after Massalongo; the others after K. Mueller.)

130 μ in diameter, deep blackish brown, becoming almost opaque with age; wing margin 16-20 μ wide; outer face areolate; areolae 25-35 μ in diameter, their boundaries indicated by grooves; inner faces smooth. We do not know why the name.—On wet soil; in springs, on banks and along streams.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 30,[53] 1916; K. Mueller (409) 1: figs. 142-143; Bischoff (458) figs. 8A-8H; Gil (76), fig. 140. EXAMINATIONS: None.

TYPE LOCALITY: Italy. RANGE: Tex. (190), La. (409); S. Amer. (195); Atlantic Isls. (409); Asia (377); Eur. (458); Africa (377).

TARGIONIA[54] L. Sp. Pl. 1136, 1753.

Thalli perennial, small to medium in size, mostly 0.5-2 cm long, dichotomous and also with ventral branches, firm and leathery, dark green, more or less purplish. Gemmae none. Upper surface more or less clearly reticulate on account of the visible walls of the air chambers. Ventral scales purple, large, in 2 rows, appendiculate. Dorsal epidermis of a single layer of cells; these pale or colorless, with distinct trigones. Air chambers

[53]There are two sets of numbers on the plates in Massalongo's article. The ones given herein are the consecutive numbers for the volume. The other numbers are consecutive for the article alone, and are three lower.

[54]tär ğï ō′ nĭ ä.

in a single layer, containing crowded simple or branched green filaments; walls of chambers one cell thick. Pores simple. Ventral tissue well developed, without thick walled cells, with scattered oil or slime cells or both. Thalli bisexual with sex organs in separate groups, or unisexual. Antheridia dorsal, usually on a short ventral branch, sometimes near the tip of an ordinary branch, in a small group, often surrounded by a row of bractlets. Archegonia in a terminal cluster on an ordinary branch, formed from dorsal cells but later appearing to be ventral. Involucre bilabiate, the edges of the lips at first in close contact; pseudoperianth none. Sporophyte consisting of sporangium with seta and foot. Seta short; foot bulbous. Sporangium with wall 1 cell thick except in apical region, the walls with complete or incomplete annular thickenings, apical portion coming off in one piece or in fragments. Elaters as well as spores formed within the sporangium. Spores reticulate. Named in honor of Giovani Targioni-Tozzetti, 1712-1783, a Florentine artist and botanist.

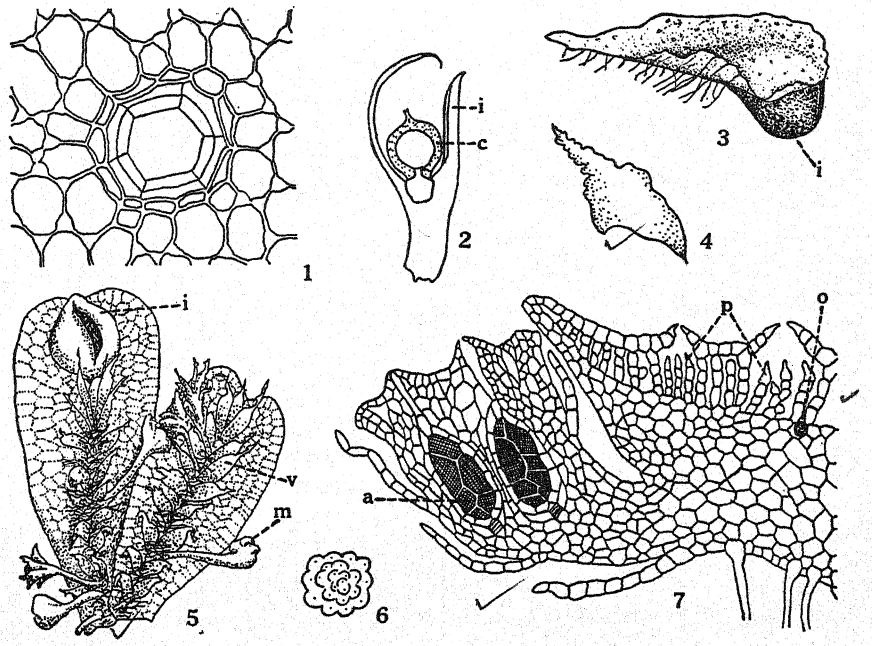
1. **Targionia hypophylla**[55] **L. Sp. Pl. 1136, 1753.**

T. michelii Corda, Opiz, Beitr. 649, 1829.
T. germanica Corda, Opiz, Beitr. 649, 1829.
T. mexicana Lehm. & Lindenb., Lehm. Stirp. Pug. 4:27, 1832.
T. capensis Hueb. Hep. Germ. 17, 1834.
T. bifurca Nees & Mont., Mont. in Ann. Sci. Nat., Ser. 2, 9:113, 1838.
T. convoluta Lindenb. & Gottsche, G. L. & N. Syn. Hep. 576, 1846.

Thalli mostly 1-2 cm long and 2-5 mm wide, plane or nearly so when moist, usually abundantly provided with ventral and apical branches, edges and under side purple. Margin often more or less incurved when dry, narrowly purple. Ventral scales scarcely reaching the margin of the thallus, large, mostly 250-450 μ long and 100-200 μ wide, entire to sparingly and irregularly spinose-dentate, the appendage linear to lanceolate. Dorsal epidermis 1 cell thick; the cells averaging about 15 x 30 μ, the trigones often bulging into the cells. Air chambers in a single layer, with filaments composed of spheroidal cells; the terminal cells when near the pores conical or flask shaped, green only near the base; walls of the chambers 1 layer of cells thick. Pores somewhat elevated, surrounded by about 3 circles of cells; cells of the inner two circles thin walled, radially arranged; cells of the third with thicker walls, irregularly arranged. Ventral tissue with more or less pitted walls, with scattered oil cells, also sometimes with slime cells. Thalli bisexual. Antheridia in a small cluster at the tip of a short ventral branch. Involucre several cells thick throughout, in its basal part forming air chambers without filaments, becoming deep blackish purple and often iridescent when old, the margins entire or

[55] hȳ pŏ' phȳl lă.

minutely toothed. Elaters mostly 8-12 μ wide, usually with 2 dark spiral bands throughout the length. Spores indistinctly tetrahedral, mostly 60-80 μ in diameter; wing margin wanting; all faces finely and irregularly



Targionia hypophylla. 1, Pore of thallus, x 187. 2, Longitudinal section of sporophyte surrounded by (*c*) calyptra and (*i*) involucre, x 6.7. 3, Plant showing (*i*) involucre, x 3.3. 4, Ventral scale of thallus, x 40. 5, Ventral view of plant, (*i*) involucre, (*m*) male branch, (*v*) ventral scale, x 3. 6, Spore, outer face, x 167. 7, Vertical section through young antheridial branch, (*a*), antheridium, (*o*) oil cell, (*p*) photosynthetic filaments, x 73. (5, after Schiffner; 2, 4, 6, after Massalongo; the others after K. Mueller.)

reticulate, the meshes 2-3 μ wide; also with a larger and more regular reticulum whose meshes are 16-20 μ wide and often incomplete. Name from Gk. *hypo,* beneath, and *phyll,* leaf; apparently in reference to the position of the sporophyte under the front end of the leaf-like thallus.—On exposed warm rocky or sandy banks and on humus in shade.

ILLUSTRATIONS: Montagne, Ann. Sci. Nat., Ser. 2, 9; pl. 3, 1838; Pearson (433) pl. 214; Massalongo, Atti Istit. Veneto 75: pl. 28, 1916; K. Mueller (409) 1: figs. 144-146; Gil (76) figs. 166-167; Macvicar (374) 33, figs. 1-3. EXAMINATIONS:—*Wash.* Republic (Foster) 1913; Seattle (Frye) 1935.—*Ore.* Myrtle Creek (Frye) 1931; Cornucopia (Rakestraw) 1935.—*Cal.* Little Bernardia Mts. (Munz) 1922; Garberville (Frye) 1931; Willow Creek (Rakestraw) 1936.

TYPE LOCALITY: European. RANGE: B. C. (513), Wash. (81), Ore. (263), Cal. (504), Nev. (296), Ariz. (184); Mex. (377); S. Amer. (399); S. Pacific (409); Asia (196); Eur. (374); Africa (388).

CLEVEA[56] Lindb., Not. Saellsk. Fauna et Fl. Fennica 9:289, 1868.

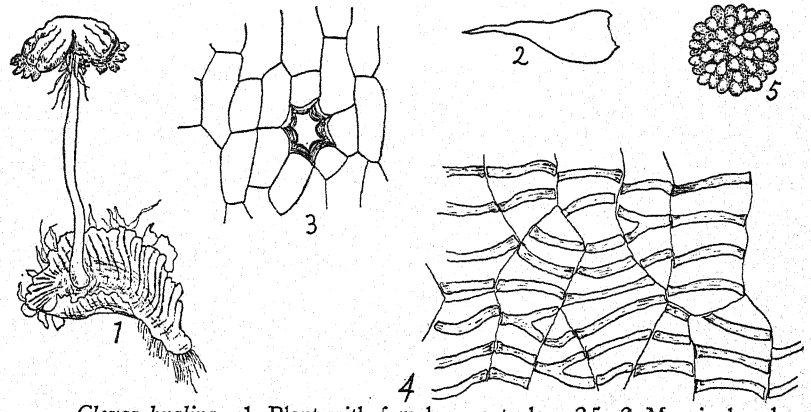
Thalli perennial, branching dichotomously and sometimes also ventrally, dull green to glaucous green throughout or somewhat purplish. Gemmae none. Upper surface showing more or less polygonal areas corresponding with the underlying air chambers. Ventral scales colorless or purplish, in 2 irregular longitudinal rows, gradually narrowed into an acuminate point but not truly appendiculate, their margins with few or no slime papillae. Dorsal epidermis distinct, unistratose; cells thin walled, with indistinct trigones. Air chambers in one or more layers, without green filaments, without supplementary walls; their walls green, 1 cell thick. Pores simple, usually stellate, with or without thickenings on the walls of the surrounding cells. Ventral tissue without sclerenchymatous cells, with scattered oil cells. Thalli unisexual or bisexual. Antheridial disk or group more or less definite, sessile, median, irregular, elongate, without surrounding bractlets. Archegonial receptacle stalked, becoming dorsal; stalk without rhizoid furrow; disk slightly convex, very deeply 2-4-lobed and the lobes extending more outward than downward, with numerous bractlets; the bractlets white or purple, with few slime papillae; archegonia arising superficially. Involucre 2-lipped; pseudoperianth none. Sporophyte of sporangium with seta and foot. Seta short. Sporangium containing both spores and elaters, dehiscing by splitting from the tip back into several valves; wall 1 cell thick except in apical region, its cells with complete brown annular thickenings. Spores coarsely papillose. Named in honor of P. T. Cleve, a phycologist and friend of Lindberg.

1. **Clevea hyalina**[57] (Sommerf.) Lindb., Not. Saellsk. Fauna et Fl. Fennica 9:291, 1868.

Marchantia cruciata var. *hyalina* Sommerf. Suppl. Fl. Lapp. 79, 1826.
Fimbriaria nana Lindenb. Hep. Eur. 109, 1829.
Marchantia hyalina Sommerf., Mag. Naturvit. 2 (1):284, 1833.
Sauteria alpina of Angstr., Bot. Notiser 1839:97, 1839, in part; not of Nees Naturg. Eur. Leberm. 4:143, 1838.
Grimaldia punicea Wallr., Linnaea 14:687, 1840.
Sauteria seriata Lindb., Hedwigia 5:33, 1866.
Sauteria hyalina Lindb., Oefv. Sv. Vetens.-Akad. Foerh. 23:561, 1866.
Sauteria suecica Lindb., Gottsche & Rabenh. Hep. Eur. 347, 1866.
Plagiochasma erythrospermum Sull., Aust. in Proc. Acad. Nat. Sci. Philadelphia 21 (1869):229, 1870.
Sauteria limbata Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869):229, 1870, in part.
C. hyalina var. *suecica* Lindb., Bot. Notiser 1877:78, 1877.
C. suecica Lindb. Musc. Scand. 1, 1879.
Aytonia erythrosperma Underw., Bull. Ill. State Lab. Nat. Hist. 2:43, 1884.
C. hyalina var. *californica* Howe, Mem. Torr. Bot. Club 7:38, 1899.

[56]klē' vē ä.
[57]hȳ ä lī' nä.

Thalli mostly 0.5-1.5 cm long and 2-6 mm wide, dichotomously branched, without ventral branches, usually dull green or glaucous green throughout, or slightly purplish along the margins and beneath. Upper



Clevea hyalina. 1, Plant with female receptacle, x 2.5. 2, Marginal scale of thallus, x 10.5. 3, Pore, x 120. 4, Thickenings in wall of sporangium, x 340. 5, Spore, outer face, x 225. (2, after Meylan; the others after K. Mueller.)

surface clearly showing polygonal areas corresponding with the air chambers beneath it. Ventral scales usually white throughout, sometimes more or less purple, projecting considerably beyond the margin, forming a more or less conspicuous apical cluster. Dorsal epidermis unistratose, with scattered oil cells; its cells averaging about 30 x 50 μ, thin walled or trigones scarcely evident. Pores simple, usually stellate but sometimes with thin radial walls, surrounded by 6-7 cells. Ventral tissue with intercellular spaces in regions which are green. Thalli unisexual. Antheridial disk or group irregular, elongate, without surrounding bractlets. Female receptacles stalked, solitary or in a short median row; the stalk mostly 0.5-1.5 cm long; the disk mostly 2.5-4 mm wide; the bractlets usually white, sometimes purple. Spores mostly 45-55 μ, reddish brown. Elaters mostly 8-12 μ wide, with 2-4 spirals in the middle and usually with 2 at each end. Name from Gk. *hyalos,* glass; from the usually white ventral scales.—In rocky situations, preferably in limestone regions.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 26, 1916; K. Mueller (409) 1: figs. 147-148; Clark and Frye (81) 14, figs. 1-5; Meylan (386) fig. 23. EXAMINATIONS:—*Vt.* Willoughby (Evans and Lorenz 842) 1913.—*S. Dak.* Rapid City (Frye) 1935.—*Colo.* West Spanish Peak (Rydberg and Vreeland) 1900.—*Mont.* Missoula (Conklin 109) 1913; Logan Pass in Glacier Nat. Park (Frye) 1929.—*Alta.* Banff (Brinkman 547) undated.—*B. C.* Burges Pass (MacFadden 1028) 1928.—*Wash.* Almota (Piper) 1894; Elwha River valley (Frye) 1907.—*Ore.* Cornucopia (Rakestraw) 1935.

TYPE LOCALITY: Norway. RANGE: Greenland (322), Ellesmere Land (197), Vt. (197), Que. (171), Colo. (175), Utah (171), Mont. (84), Alta. (51), B. C. (197), Ida. (81), Wash. (81), Ore. (457), Cal. (296); Eur. (329).

SAUTERIA[58] Nees Naturg. Eur. Leberm. 4:139, 1838.

Hampea[59] Nees Naturg. Eur. Leberm. 4:139, 1838, as synonym; not of Schlecht. 1837.

Thalli perennial, sparingly dichotomous, with numerous ventral branches, dull green or glaucous. Gemmae none. Upper surface showing polygonal areas, one over each air chamber. Ventral scales colorless, in more than 2 irregular longitudinal rows, gradually narrowed into an acuminate point but not truly appendiculate, their margins with numerous slime papillae. Dorsal epidermis distinct, unistratose, colorless; cells thin walled, usually with more or less distinct trigones. Air chambers without supplementary partitions, green tissue loose; walls unistratose, green; green filaments wanting. Pores simple, distinctly stellate. Ventral tissue without schlerenchyma. Thalli bisexual, male and female organs in separate groups or rarely the former just below the latter. Antheridial receptacle sessile, median, irregular, elongate, without marginal bractlets. Female receptacle stalked, terminal on a very short branch and thus apparently lateral, with fairly numerous white bractlets along the margin which bear numerous slime papillae; its stalk with 1 rhizoid furrow, without green tissue; disk deeply 3-5-lobed, slightly convex, the lobes extending outward at about 45 degrees with the stem. Involucre 2-lipped; pseudoperianth none. Sporophyte composed of sporangium with seta and foot. Seta short. Sporangium with wall 1 cell thick except near apex, containing both elaters and spores, opening by several splits from the tip backward; thickenings within the wall cells brown, incompletely annular. Spores coarsely papillose. Named in honor of A. Sauter, 1800-1881, a doctor of Mittersill, Austria. The town is near lat. 47° 15′ N. and long. 12° 30′ E.

1. **Sauteria alpina**[60] Nees Naturg. Eur. Leberm. 4:143, 1838.

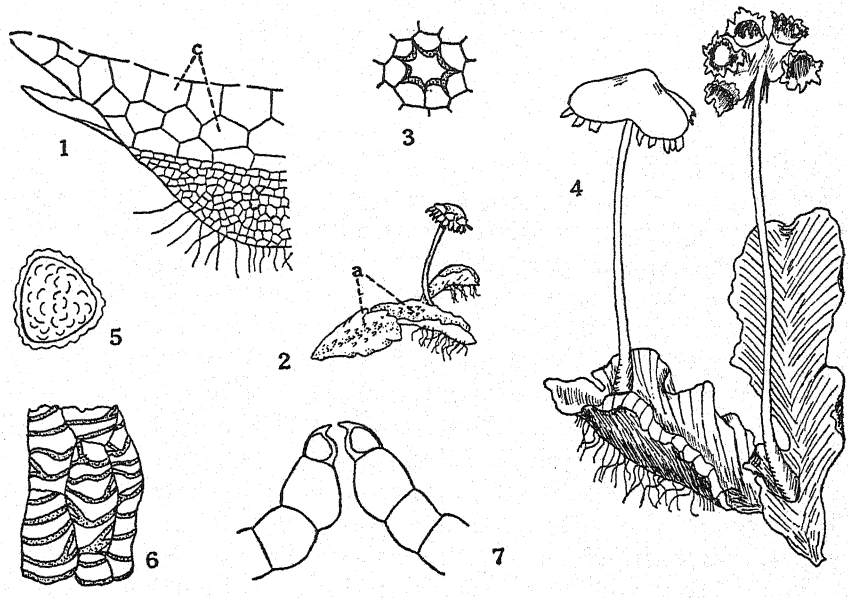
Lunularia alpina Nees, Bischoff & Nees in Flora 13:399, 1830.

Thalli mostly 0.5-1.5 cm long and 3-5 mm wide, oval or lingulate to narrowly rectangular, 1-2 times dichotomous, with erect-spreading wings. Upper surface clearly showing polygonal areas coinciding with the chambers beneath. Vein a rounded keel beneath, wide. Ventral scales translucent, long, narrow, scarcely reaching the margin and not forming a conspicuous apical cluster. Dorsal epidermis of cells averaging about 30-50 μ, often disappearing over the chambers with age, oil cells scattered. Pores elevated, usually bordered by 6 cells with distinctly thickened radi-

[58] saw tēr′ ĭ ă.

[59] *Hampea* was used in 1837 by Schlechtendal for a genus in the family *Bombaceae* (Linnaea 11:371, 1837).

[60] ăl pī′ nă.



Sauteria alpina. 1, Cross section of thallus, (*c*) chambers, x 80. 2, Plant with female receptacle and (*a*) antheridia, x 5.3. 3, Pore of thallus, x 167. 4, Plant with female receptacles, x 4. 5, Spore, outer face, x 167. 6, Thickenings in wall of sporangium, x 167. 7, Vertical section through pore, x 187. (4, 7, after K. Mueller; the others after Massalongo.)

al and inner walls. Antheridia usually on a ventral branch, more rarely on a part of a dichotomous branching. Female receptacle with stalk mostly 1-1.5 cm long; disk about 2 mm wide. Elaters about 10 μ wide, with 2-4 brown spirals, 10 μ wide, about 240 μ long. Spores mostly 60-70 μ in diameter, yellowish brown, warty. Name probably from its alpine habitat.—On rocks along streams or in wet shady places among broken rocks; calciphile.

ILLUSTRATIONS: Bischoff, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17: pl. 67, figs. 22-28, 1835; Massalongo, Atti Istit. Veneto 75: pl. 25, 1916; K. Mueller (409) 1: figs. 150-151; Schiffner (458) fig. 14. EXAMINATIONS:—*Alaska.* St. Paul Isl. (Kincaid) 1897.—*B. C.* Hector (Brinkman 805) 1913; Mt. Edith (Brinkman 831) 1913.—*Alta.* Banff (Brinkman 577) 1912.

TYPE LOCALITY: Austria. RANGE: Greenland (322); Que. (197); Alta. (373), B. C., Alaska (190); Asia (350); Eur. (410).

PELTOLEPIS[a] Lindb., Bot. Notiser 1877:73, 1877.

Thalli perennial, regularly dichotomously branched, bright green and somewhat purplish. Gemmae none. Upper surface showing polygonal areas coinciding with the chambers beneath them. Ventral scales in 2

[a] pĕl tŏ' lĕ pŭs.

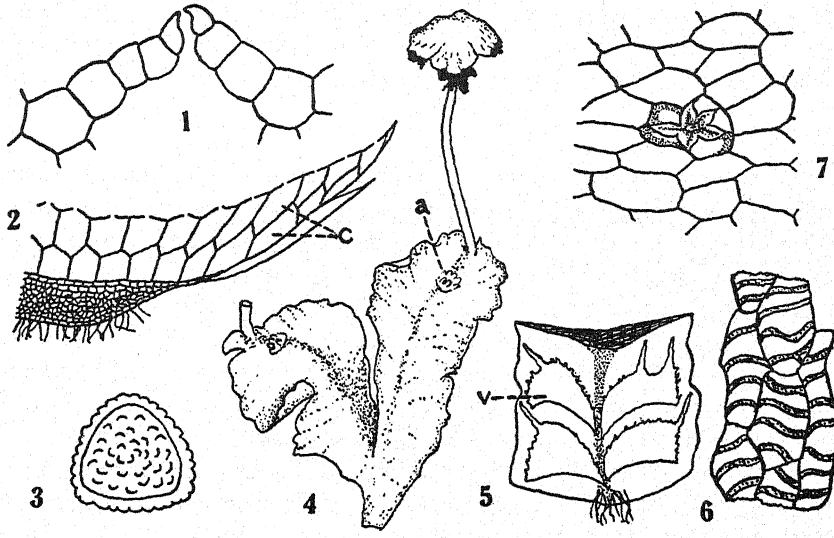
rows. Dorsal epidermis distinct, of 1 layer of cells; the cells mostly colorless, with more or less distinct trigones, some of them containing oil bodies. Air chambers in 1-2 layers; walls 1 cell thick, supplementary walls none; green filaments none. Pores more or less stellate. Ventral tissue without schlerenchyma. Thalli bisexual. Antheridial receptacles dorsal, not limiting the growth of the branch, sometimes on different branches from the female, circular in outline, slightly elevated, sessile, with marginal bractlets. Female receptacles terminal on a somewhat elongated branch, sometimes in a median area, stalked, with numerous purple bractlets bearing many slime papillae; stalk with 2 rhizoid furrows, without green tissue; disk somewhat convex, deeply 3-10-lobed, extending outward at 40-50 degrees with the stalk. Involucre 2-lipped; pseudoperianth wanting. Sporophyte composed of sporangium with seta and foot. Seta short. Sporangium containing both spores and elaters, splitting open by rents from the tip backward, its wall 1 cell thick; wall cells pale, with complete annular thickenings. Spores coarsely papillate. Name from Gk. *pelte,* a semilunar shield, and *lepis,* a scale; referring to the semilunar ventral scales of the thallus of *P. grandis.*

Peltolepis grandis[62] Lindb., Bot. Notiser 1877:74, 1877.

Sauteria alpina of Angstr., Bot. Notiser 1839:97, 1839, in part; not of Nees Naturg. Eur. Leberm. 4:143, 1838.
Sauteria grandis Lindb., Medd. Soc. pro Fauna et Fl. Fennica 1:113, 1876.
P. sibirica Lindb., Acta Soc. pro Fauna et Fl. Fennica 2 (3):4, 1882.
P. grandis var. *sibirica* Lindb., Medd. Soc. pro Fauna et Fl. Fennica 9:162, 1883.
P. grandis var. *angustifrons* Lindb., Lindb. & Arnell in Sv. Vet.-Akad. Handl. 23 (5):13, 1889.

Thalli mostly 1-2 cm long and 5-7 mm wide, sometimes distinctly narrower, strongly convex beneath, the sides thin and wing-like, green or purplish, distinctly purplish beneath. Dorsal groove present. Marginal wings erect-spreading. Ventral scales semilunar, white or purplish; their appendages lanceolate. Dorsal epidermis of one layer of cells, with scattered oil cells; cell walls distinct, often with trigones. Pores slightly elevated, usually bounded by 5-6 cells; radial walls of these cells usually thickened, the thickenings ovate-lanceolate in surface view when well developed. Thalli bisexual. Antheridial receptacles below the female ones on normal branches of the thallus, or sometimes on special male branches. Female receptacle stalked, terminal on a thallus or its branch; stalk mostly 0.5-1 cm long, with abundant bractlets toward tip; these bractlets lanceolate, with many slime papillae; disk about 3 mm wide. Elaters 8-10 μ wide, with 2-3 yellow spirals. Spores mostly 45-50 μ in diameter, dark brown. L. *grandis,* great. This was first put into the genus *Sauteria,* it

[62]grăn' dĭs.



Peltolepis grandis. 1, Vertical section of pore, x 150. 2, Cross section of thallus, (*c*) chambers, x 200. 3, Spore, outer face, x 250. 4, Plant, (*a*) antheridial receptacle, x 3. 5, Ventral view of portion of thallus, (*v*) ventral scale, x 25. 6, Thickenings in wall of sporangium, x 250. 7, Pore of thallus, x 150. (1, 4, 7, after K. Mueller; the others after Massalongo.)

is surmised the name refers to its size as compared with *Sauteria alpina.* —Among rocks along streams; on moist cliffs; calciphile.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 24, 1916; K. Mueller (409) 1: figs. 152-153; Zamerling, Flora 84: fig. 20, 1897; Meylan (386) fig. 25. EXAMINATIONS:—*B. C.* New Denver Glacier (MacFadden 229) 1925.

TYPE LOCALITY: Scandinavian Peninsula. RANGE: Greenland (322); Ellesmere Land (325), B. C. (51); Asia (350); Eur. (386).

PLAGIOCHASMA[63] Lehm. & Lindenb., Lehm. Stirp. Pug. 4:13, 1832.

Aytonia Forst. Char. Gen. Pl. 147, 1776.
Rupinia L. fil. Suppl. 69, 1781.
Aitonia Forst., Comm. Soc. Reg. Gott. 9:46, 1789; not of Thunb. 1776.
Sedgwickia Bisch., Leopoldina 18 (2):1079, 1835; not of Bowd. Excursions in Madeira and Porto Santo 4:35, 1830.[64]
Anthrocephalus Lehm., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 18:682, 1836.
Otiona of Dum. Hep. Eur. 148, 1874; not of Corda, Opiz, Beitr. 1:648, 1829.

Thalli perennial, firm, dichotomous and also with ventral branches, somewhat purple. Gemmae none. Upper surface not distinctly divided into polygonal areas. Ventral scales in 2 longitudinal rows, appendiculate. Dorsal epidermis distinct, pale or colorless, sometimes somewhat

[63] plā" ĝĭ ō kăs' mă.
[64] Nees (Naturg. Eur. Leberm. 4:11, 1838) shows that *Sedgwickia hemisphaerica* of Bowdich is *Lunularia vulgaris.*

waxy, without oil cells, 1 cell thick; the cells thin walled, with more or less distinct trigones. Air chambers more or less divided by supplementary walls and thus apparently several layers deep in median region; green filaments wanting; walls 1 cell thick; green tissue loose. Pores simple, minute or larger, surrounded by 4-10 radial rows of 1-3 cells each, their walls thin to thick. Cells of ventral tissue all thin walled, some oil cells present. Thalli unisexual or bisexual. Antheridial receptacles sessile, well defined, with simple pores, with fringe of bractlets, soon becoming dorsal, continuing their growth directly; the antheridia in acropetal succession. Female receptacle stalked, soon becoming dorsal; stalk without rhizoid furrow, with scattered slender bractlets; disk convex to concave, its lobes more or less distinct, often apiculate; archegonia usually borne singly. Involucre 2-lipped, entire; pseudoperianth wanting. Sporophyte composed of sporangium with seta and foot. Seta very short; foot bulbous. Sporangium with indistinct lid which falls away in fragments in dehiscence; wall 1 cell thick; wall cells without annular thickenings. Elaters usually with spirals, rarely with uniformly thickened walls. Spores tetrahedral, wing margined, usually reticulate on the faces through anastomosing ridges. Gk. *plagios,* lateral, and *chasma,* opening; referring to the lateral opening of the involucre.

Fertile and sterile plants both unsegmented; areolae of the outer spore face mostly 15-20 μ; pores usually bounded by 4-6 cells.
Epidermal pores inconspicuous, not elevated, usually surrounded by one circle of 4-6 cells with no further radiate cells..... 1. *P. rupestre.*
Epidermal pores conspicuous, usually surrounded by 6 radial rows of 2-3 cells each..... 2. *P. wrightii.*
Fertile plants composed of wedge-shaped segments; areolae of the outer spore face 30-38 μ; pores conspicuous, usually bounded by 7-8 cells, with 2-3 cells in each radial row..... 3. *P. cuneatum.*

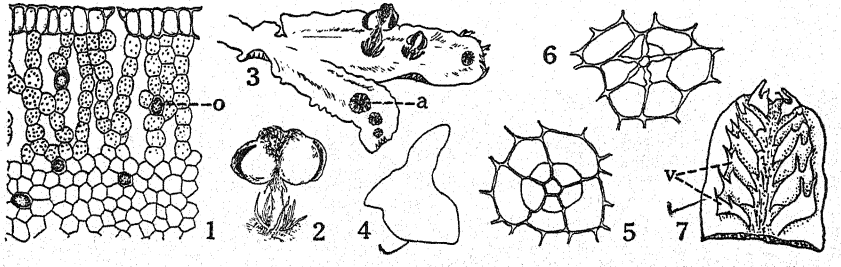
1. Plagiochasma rupestre[65] **(Forst.) Steph., Bull. Herb. Boissier 6:783, 1898.**

Aytonia rupestris Forst. Char. Gen. Pl. 147, pl. 74, 1776.
Rupinia lichenoides L. fil. Suppl. Pl. Syst. Veg., Ed. 13, 69, 1781.
Rupinia rupestris Sw. Meth. Musc. 39, 1781.
Rebouillia madeirensis Raddi, Giorn. Sci. Lett. Arti., 1821.
Corsinia lamellosa Nees & Bisch., Flora 13:401, 1830.
Sedgwickia hemisphaerica of Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17:1079, pl. 70, fig. 4, 1835; not of Bowd. Excursions in Madeira and Porto Santo 4:35, 1830, which was *Lunularia cruciata.*
P. aitonia Lindenb. & Nees, Nees Naturg. Eur. Leberm. 4:41, 1838.
Anthrocephalus italicus Sassi, Atti Prim. Riun. Sci. Ital. 1:160, 1840.
Jungermannia australis Tayl., Hook. fil. & Tayl. in London Jour. Bot. 3:572, 1844.
Jungermannia limbata Tayl., Hook. fil. & Tayl. in London Jour. Bot. 4:95, 1845.
P. australe Nees, G. L. & N. Syn. Hep. 515, 1846.
P. limbatum Nees, G. L. & N. Syn. Hep. 516, 1846.
P. elongatum Lindenb. & Gottsche, G. L. & N. Syn. Hep. 519, 1846.
P. mexicanum Lindenb. & Gottsche, G. L. & N. Syn. Hep. 519, 1846.

[65] rū pēs' tĕr.

P. italicum DeNot., Mem. Real. Accad. Torino, Ser. 2, 18:476, pl. 1, 1859.
Aitonia italica Lindb., Not. Saellsk. Fauna et Fl. Fennica 9:291, 1868.
Otiona rupestris Dum. Hep. Eur. 148, 1874.
Otiona italica Dum. Hep. Eur. 149, 1874.
Rupinia italica Trev., Rend. Istit. Lomb., Ser. 2, 7:785, 1874.
Rupinia mexicana Trev., Mem. Istit. Lomb. 13:437, 1877.
Rupinia elongata Trev., Mem. Istit. Lomb. 13:437, 1877.
Rupinia limbata Trev., Mem. Istit. Lomb. 13:437, 1877.
Rupinia australis Trev., Mem. Istit. Lomb. 13:437, 1877.
Aitonia lanigera Spruce, Trans. Bot. Soc. Edinburgh 15:568, 1885.
Aitonia australis Steph., Hedwigia 28:129, 1889.
Aytonia elongata Underw., Bot. Gaz. 20:66, 1895.
Aytonia mexicana Underw., Bot. Gaz. 20:66, 1895.
P. lanigerum Steph., Bull. Herb. Boissier 6:788, 1898.
Aytonia evansii Haynes, Bull. Torr. Bot. Club 34:57, pl. 5, 1907.

Thalli mostly 1-2 cm long and 5-7 mm wide, sometimes dichotomously branched, sometimes with ventral branches, often with innovations from the apex, pale green, glaucous, purplish below and marginally above. Dorsal groove none or very shallow. Vein a broad round ventral keel. Margin purplish. Ventral scales deep purple, appendiculate; appendages



Plagiochasma rupestre. 1, Portion of cross section of thallus, (*o*) oil cell, x 70. 2, Female receptacle bearing 2 sporophytes, x 3.5. 3, Thallus, (*a*) antheridial receptacle, x 2. 4, Ventral scale (quite variable with locality), x 20. 5, 6, Pores of the thallus (differing greatly in various localities), x 150. 7, Portion of thallus, ventral view, (*v*) ventral scales, x 6. (1, 2, 3, After Mueller; 7, after Massalongo; the others after Evans.)

1-2 or rarely 3, ovate-lanceolate to lanceolate, acute to acuminate, entire, slightly or not at all constricted at the base, with waxy cuticle. Dorsal epidermis without oil cells; its cells mostly 18-30 μ in diameter, with small trigones. Green tissue fairly compact. Pores not elevated, very inconspicuous; the bounding cells a single circle, 4-6, often with somewhat thickened radial walls. Thalli bisexual. Antheridial receptacle sometimes on the same branch of the thallus as the female, sometimes on a more or less elongate male branch. Female receptacle stalked, single or in median longitudinal series; stalk usually 3 mm or less long; disk mostly 2-3 mm wide, concave, with usually 2-3 apiculate lobes, with numerous bractlets; these bractlets entire, narrowly subulate, with elongate filiform points. Elaters about 10 μ wide, with 2-4 spirals, sometimes somewhat

coalescent. Spores 70-90 μ, minutely rugulose; faces regularly although often incompletely areolate; areolae mostly 15-20 μ wide. Name from L. *rupestre,* of rocks; from the rupestral habitat.—On damp rock walls and cliffs.

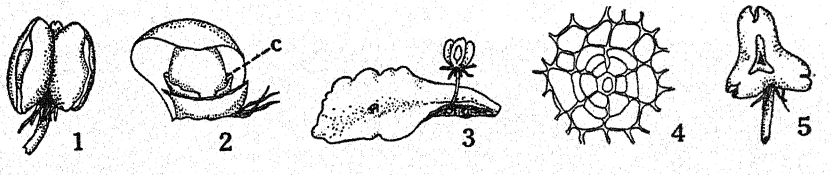
ILLUSTRATIONS: DeNotaris, Mem. Accad. Torino, Ser. 2, 18: pl. 1, 1859; Haynes, Bull. Torr. Bot. Club 34: pl. 5, 1907; Massalongo, Atti Istit. Veneto 75: pl. 23, 1916; Evans, Bull. Torr. Bot. Club 42: figs. 1-4, 1915; K. Mueller (409) 1: figs. 154-155. EXAMINITIONS: None.

TYPE LOCALITY: Madeira. RANGE: N. Mex. (272), Ariz. (481); Mex. (174); West Indies (207); S. Amer. (55); Galapagos Isl. (207); Tahiti (406); N. Z. (207); Australia (174); Asia (207); Eur. (377); Azores (409); Africa (388); San Juan Fernandez (207).

2. **Plagiochasma wrightii**[66] Sull., A. Gray Manual, Ed. 2, 688, pl. 6, 1856.

Aitonia wrightii Underw., Bull. Ill. State Lab. Nat. Hist. 2:43, 1884.

Thalli 1.5-2 mm long and 3-5 mm wide, dichotomously or ventrally branched, sometimes with apical innovations, pale green or glaucous above, with a narrow purple border, purple beneath. Dorsal groove want-



Plagiochasma wrightii. 1, Side view of female receptacle with cleft in involucre, x about 4. 2, Involucre partly removed to show sporangium, (*c*) calyptra, x about 5. 3, Plant, x about 1.5. 4, Pore of thallus, x 150. 5, Top view of female receptacle, x about 4. (4, after Evans; the others after Underwood.)

ing or wide. Vein a broad round ventral keel. Margin purple, undulate-crenate, somewhat crispate. Ventral scales purple, slightly inbricate, appendiculate; their appendages single or paired, ovate-lanceolate, obtuse to acute, entire, somewhat constricted and plicate at base. Dorsal epidermis without oil cells; its cells about 22 μ, with distinct trigones, with thin waxy cuticle. Green tissue rather loose. Pores simple, slightly elevated, conspicuous, surrounded by about 6 radial rows of 2-3 cells each, with radial walls thickened. Thalli bisexual. Antheridial receptacle behind a female one or on a short ventral branch, sessile. Female receptacles single or in a short median row, stalked; stalk 2-4 mm long, without green tissue; disk about 3 mm wide, narrowly concave at apex, with 2-3 apiculate lobes, with bractlets; the bractlets linear-lanceolate, acuminate, entire. Elaters 7-9 μ wide, with 2-3 spirals, often somewhat coalescent. Spores

[66] rī' ti ī.

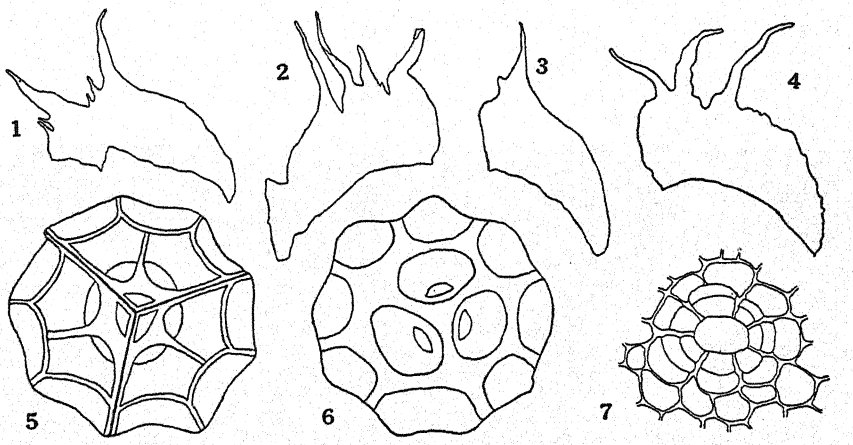
75-85 μ, minutely rugulose, yellowish brown; faces regularly areolate; areolae mostly 15-20 μ wide. Named in honor of C. Wright who first found it.—Under overhanging rocks along streams.

ILLUSTRATIONS: Underwood, in A. Gray's Manual, Ed. 6, pl. 22, 1889; Evans, Bull. Torr. Bot. Club 42:297, fig. 6, 1915. EXAMINATIONS:—*Tex.* San Antonio (Schulz) 1922.—*Ariz.* Palagonia (Eastwood) 1930.

TYPE LOCALITY: Texas (C. Wright). RANGE: Okla. (181), Tex. (354), N. Mex. (272), Ariz. (99); Mex. (174).

3. **Plagiochasma cuneatum**[67] Evans, Amer. Jour. Bot. 19:627, figs. 1-32, 1932.

Thalli mostly 7.5-10 mm long, 3-4 mm wide, ligulate, rarely forking, occasionally branching ventrally, fruiting plants composed of joints formed as apical innovations, bright green above except the margins, deep purple below and marginally, often with a greenish metallic iridescence



Plagiochasma cuneatum. 1-4, Various forms of ventral scales, x 18. 5, Spore showing three plane inner faces, x 313. 6, Spore, outer face, x 313. 7, Pore of thallus, x 200. (All after Evans.)

when dry. The purple margin slightly crispate. Thickness of thallus about 1/5 the width. Ventral scales lunate, slightly overlapping and covering the ventral surface of the thallus, irregularly sinuate or sinuate-dentate, appendiculate, composed of irregular cells; their walls almost opaque, strongly purplish; oil cells present, shorter than the others, their walls not colored; appendages 1-2-4, purplish or sometimes bleached toward tip, subulate to narrowly so, long acuminate, apex usually a row of 3-5 cells, margin entire or rarely with one or more short cilium-like teeth. Dorsal surface plane or nearly so when moist, the wings strongly incurved when

[67] kū nē ā′ tŭm.

dry and more or less concealing the upper surface; dorsal epidermis without oil cells, colorless; its cells thin walled, averaging about 21 μ, with trigones; trigones small but distinct, occasionally coalescent, with straight or slightly concave sides; cuticle very finely verruculose. Pores distinctly elevated, conspicuous, surrounded by 4-7-10 radiating rows of 2-3 cells each, their radial walls distinctly thickened. Aeriferous layer about 5/8 the thickness of the thallus, the upper half much greener than the lower and showing air spaces about twice as wide as their walls; oil cells occasionally present among the green cells and in the compact ventral tissue. Thalli normally bisexual. Both inflorescences terminal until (nearly always) apical innovation takes place; innovations becoming cuneate, thus the whole thallus segmented with the narrow end of each segment posterior. Female receptacle stalked; stalk 3-5 mm long, deep purple on outside, colorless inside; disk with shallow apical depression, usually 2-3-lobed, the lobes bluntly pointed or rounded, with bractlets; bractlets linear-lanceolate, entire. Elaters mostly 200-300 μ long, 10-12 μ thick, reddish brown, gradually attenuate, with 2-3 spirals more or less connected by longitudinal bands of thickening, the thin places in the walls of the elaters somewhat pigmented. Spores 95-110 μ, minutely verruculose, coarsely reticulate, deep golden brown in transmitted light; outer face usually with 11-13 areolae each 30-38 μ; inner face with 4-5 areolae; verruculae of rods or ridges, the latter sometimes coalescing to form a delicate and often incomplete network. L. *cuneatus,* wedge-shaped; from the form of the segments of the fertile thalli.—On soil.

ILLUSTRATIONS: Evans, Amer. Jour. Bot. 19:627-631, figs. 1-7, 1932. EXAMINATIONS: None.

TYPE LOCALITY: Hamilton's Pool, about 30 miles west of Austin, Texas (F. McAllister), Feb. 1931. RANGE: Known only from the type collection.

MANNIA[68] Corda, Opiz, Beitr. 646, 1828.

Duvalia[69] of Nees, Mag. Gesel. Nat. Freunde Berlin 8:271, 1817; not of Haworth, 1812.[69]
Grimaldia[70] of Raddi, Opusc. Sci. Bologna 2:357, 1818; not of Schrank, Bot. Zeit. Regensb. 4:184, 1805.
Sindonisce Corda, Opiz, Beitr. 658, 1829.
Grimmaldia Endl. Gen. 44, 1836.
Rebouillia Griffith Not. Pl. Asiaticas, 1849.
Neesiella[71] Schiffn., Engler & Prantl Nat. Pfl.-Fam. 1 (3) 2:32, 1893.

[68] măn' nĭ ă.
[69] *Duvalia* was applied by Haworth to a genus of flowering plants in the family Asclepiadaceae.
[70] *Grimaldia* was first a genus of flowering plants in the family Leguminosae. It is retained by Britton and Rose as a genus in the Caesalpiniaceae in North American Flora 23:299, 1930. Much as one may regret it, the name cannot be retained in the hepaticae, as has been pointed out by Wheeler in Bryologist 37:87-88, 1934.
[71] *Neesiella* was erected by Schiffner on the basis of a rhizoid furrow on the stalk of the female receptacle, which was presumably not present in *Grimaldia,* but since it is also present in the latter, there remains no good reason for retaining *Neesiella* as a genus.

Thalli perennial, small to medium in size, dichotomous, also with apical innovations, sometimes with ventral branches, usually more or less purplish, delicate to firm in texture. Gemmae lacking. Ventral scales in 2 rows, appendiculate. Dorsal epidermis distinct, colorless or pale, 1 cell thick, with some oil cells; its cells with thin or thick walls, often with distinct trigones. Air chambers apparently in more than one layer, sparingly to closely subdivided by supplementary partitions, their margins sometimes bearing short teeth; the partitions 1 cell thick; green filaments wanting; green tissue loose to compact. Pores simple, surrounded by several radiating rows of cells, the radial walls thin or more or less thick. Ventral tissue sometimes with oil cells, without sclerenchymatous cells, with thin unpitted walls. Thalli unisexual or bisexual. Antheridia on more or less distinct sessile receptacles, or forming an irregular median dorsal group, arising in acropetal succession from the base; the epidermal pores associated with the antheridia simple. Female receptacles terminal, stalked; stalk without green tissue; with 1 rhizoid furrow, disk strongly convex above, with low coarse tubercles, slightly or not at all lobed; its pores barrell-shaped; lobes mostly 3-4 when present; archegonia 1-4 beneath each lobe or its equivalent. Involucre membranous, not 2-lobed although sometimes less developed on the side next to the stalk, reaching to the margin of the disk; pseudoperianth wanting. Sporophyte of sporangium with seta and foot. Seta short; foot bulbous. Sporangium wall 1 cell thick in apical region, with distinct lid which remains intact in dehiscence, containing both elaters and spores. Elaters with 2 or more spirals. Spores tetrahedral; winged at edges, reticulate on the outer or on all faces.—We do not know why the name Mannia.

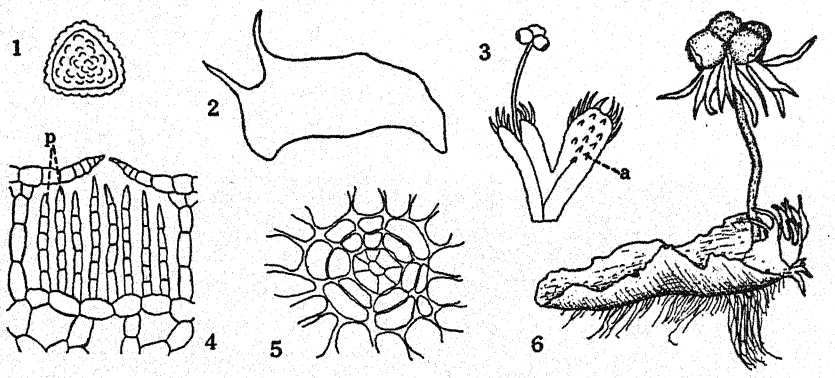
Green tissue compact in structure; plants of xerophytic habit; margins of the thallus strongly incurved when dry.
- Appendages of the ventral scales white, forming a conspicuous apical cluster at least on the fruiting plants; female receptacle commonly on an ordinary branch..... 1. *M. fragrans.*
- Appendages of the ventral scales mostly purple, not forming a conspicuous apical cluster; female receptacle commonly on a short ventral branch..... 2. *M. californica.*

Green tissue loose in structure; plants not of xerophytic habit; margins of the thallus not to distinctly incurved when dry.
- Stalk of female receptacle with conspicuous cluster of bracts at base and at apex; epidermis of thallus thin walled or with trigones; spores yellowish brown..... 3. *M. pilosa.*
- Stalk of female receptacle with conspicuous cluster of bracts at base but few at apex; epidermis of thallus thick walled, tough, leathery; spores light yellow..... 4. *M. sibirica.*
- Stalk of female receptacle with few or no bracts at base and at apex; epidermis of thallus thin walled or with trigones; spores yellowish brown..... 5. *M. rupestris.*

1. Mannia fragrans[72] **(Balbis) n. comb.**

Marchantia fragrans Balbis, Mem. Acad. Turin 7:76, pl. 2, fig. 3, 1804.
Marchantia tenella of Schweinitz Hep. Amer. Septentr. 23, 1821; not of L. Sp. Pl., Ed. 2, 1604.
Sindonisce fragrans Corda, Opiz, Beitr. 648, 1829.
Grimaldia barbifrons Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17:1028, 1835.
Grimaldia fragrans Corda, Nees Naturg. Eur. Leberm. 4:225, 1838.
Grimaldia inodora Wallr., Linnaea 14:686, 1840.
Grimaldia sessilis Sull., A. Gray Manual, Ed. 2, 688, 1856.
Duvalia fragrans Lindb., Not. Saellsk. Fauna et Fl. Fennica 9:285, 1868.

Thalli usually aromatic when fresh, mostly 1-2 cm long and 2-3 mm wide, mostly dichotomously but sometimes ventrally branched, green or glaucous green in upper middle, purplish along margin, deep purple beneath. Vein forming a rounded or bluntly angled keel beneath. Margin undulate, strongly recurved when dry. Ventral scales deep purple, close-



Mannia fragrans. 1, Spore, outer face, x 167. 2, Ventral scale of thallus, x 12. 3, Plant with female receptacle and (*a*) antheridial one, x 6. 4, Vertical section through pore and chamber, (*p*) photosynthetic filaments, x 167. 5, Pore of thallus, x 200. 6, Plant with female receptacle, x 4. (1, 3, 4, after Massalongo; the others after K. Mueller.)

ly imbricate, lunate, with marginal appendages; appendages 1-3, subulate, mostly 450-700 μ long and 90-150 μ wide, acuminate, entire, sometimes purple but usually somewhat bleached, considerably larger in fruiting plants and forming a dense white apical cluster. Dorsal epidermis distinct; its cells averaging about 14 x 17 μ, with thick walls, usually with conspicuous trigones; oil cells few, scattered. Air chambers with crowded vertical supplementary partitions; walls unistratose; green tissue compact. Pores slightly elevated; surrounding cells radiately arranged in 6-8 radial rows, each of 2 or 3 cells, their radial walls more or less thick. Ventral tissue with some oil cells. Thalli unisexual or bisexual. Antheridial receptacle sessile, distinct, oval to broadly lunate, limiting the growth of

[72]frā' grăns.

the somewhat elongate male branch. Female receptacle stalked, from a somewhat elongate branch; stalk mostly 1-1.5 cm long, somewhat purplish, with dense clusters of long lanceolate bractlets at base and at apex; disk mostly 2-3 mm wide, shortly 3-4-lobed. Elaters pale brown to dark brown, mostly 8-10 μ wide, usually with 2-3 spirals in the middle and 2 at the ends. Spores mostly 60-70 μ; wing margins wavy, 8-10 μ wide; faces minutely and indistinctly punctate, coarsely areolate; areolae fairly regular, mostly 10-15 μ wide. Name from the aromatic odor of the fresh thallus.—On thin soil on rock. Often rather exposed; calciphile.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 21, 1916; K. Mueller (409) 1: figs. 159a, 160-161; Underwood, Gray's Manual, Ed. 6, pl. 23, 1889; Schiffner (458) figs. 17D-17F; Meylan (386) figs. 27a-27c, 27e. EXAMINATIONS:—*Conn.* New Melford (Nichols 68) 1910; New Haven (Haynes) 1911; Hartford (Lorenz) 1912.—*Vt.* Brandon (Dutton) 1924.—*N. Y.* Kingston (Williams 685) 1903.—*Wis.* Glen Haven (Allen) 1921; Bay City (Wilson) 1927; Bradford (Cheney) 1928.—*Minn.* Winona bluffs (Holzinger) 1901; Granite Falls (Holzinger) 1901.—*Mo.* Cliff Cave ("J. H. K." 54) 1903.—*Colo.* Foothills (Crandell) 1896.

TYPE LOCALITY: Northern Italy (Balbis). RANGE:[73] Greenland (325), Vt. (140), Mass. (203), R. I. (140), Conn. (187), N. J. (513), N. Y. (58), Que. (212), Pa. (513), Ill. (529), Wis. (98), Minn. (518), Iowa (469), Mo. (513), Neb. (204), Colo. (175), Ida. (508), N. Mex. (272), Tex. (212), Ala. (198); Asia (458); Eur. (377).

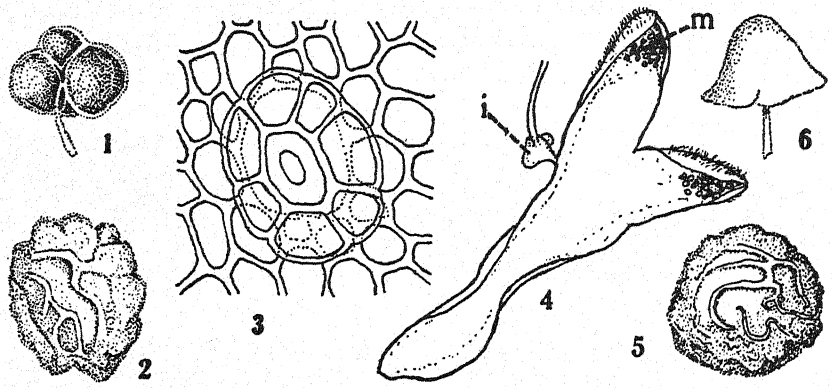
2. **Mannia californica**[74] (Gottsche) Wheeler, Bryologist 37:88, 1934.

Grimaldia californica Gottsche, Underw., Bot. Gaz. 13:114, 1888.

Thalli mostly 1-2 cm long and 2-4 mm wide, branched dichotomously and ventrally, rarely with apical innovations, green above in middle region, somewhat purplish along margin and beneath. Vein a rounded keel beneath. Margin undulate, strongly incurved when dry, purplish. Ventral scales imbricate, lunate to narrowly ovate, purple; their appendages single or paired, subulate, 300-400 μ long and 70-90 μ wide, acuminate, entire, usually purple, not forming a dense apical cluster; dorsal epidermis distinct, without oil cells; its cells averaging 23 μ, with slightly thickened walls, with small distinct trigones. Air chambers with crowded vertical supplementary partitions; walls unistratose; green tissue compact. Pores somewhat elevated; surrounding cells arranged in 5-7 radial rows of 2-3 cells each, the radial walls scarcely thickened. Thalli unisexual or bisexual. Antheridial receptacle hardly formed; antheridia in irregular and hardly defined median elongate clusters, not limiting the growth of the somewhat elongate male branch. Female receptacle on a short obovate or cordate ventral branch, stalked; stalk 1.5-2.5 cm long, more or less reddish, naked above, with a few slender scales at the base; disk 1.5-2

[73] It has been reported from Alaska (212) but we are uncertain whether the material was this species or *M. pilosa*.

[74] kăl ĭ fôr' nĭ că.



Mannia californica. 1, Under side of female receptacle with the sporangia open, x 8. 2, Spore, x 305. 3, Pore of thallus x 305. 4, Thallus, (*m*) male receptacle, (*i*) innovation with stalk of female receptacle, x 3. 5, Spore, outer face, x 305. 6, Side view of female receptacle with spores fallen, x 8. (All after Howe.)

mm wide, obscurely mostly 3-4-lobed. Elaters purple, mostly 9-15 μ wide, usually with 3 spirals. Spores mostly 55-75 μ, dark purple; wing margin obscure, about 4 μ wide; faces minutely punctate; outer face with low ridges which sometimes form areolae; areolae 12-16 μ wide; inner faces similar to outer but less distinctly areolate. Name from the state in which it was first found.—On wet rocks.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 92, 1899. EXAMINATIONS: None.

TYPE LOCALITY: Yosemite Falls, California (Bolander), June 1866. RANGE: N. C. (43), Ariz. (184), Cal. (296).

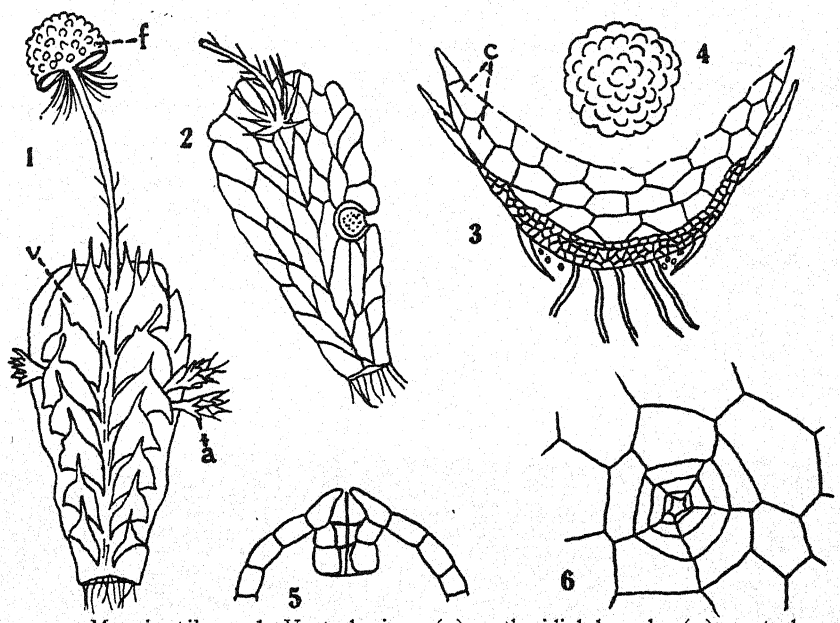
3. **Mannia pilosa**[75] (Hornem.) n. comb.

Marchantia pilosa Hornem. Fl. Dan. 8:7, pl. 1426, 1810.
Duvalia pilosa Lindb., Not. Saellsk. Fauna et Fl. Fennica 9:280, 1863.
Grimaldia pilosa Lindb. Musc. Scand. 1, 1879.
Grimaldia carnica Massal., Ann. Istit. Bot. Roma 2:54, 1886.
Neesiella carnica Schiffn., Hedwigia 47:314, 1908.
Neesiella pilosa Schiffn., Hedwigia 47:314, 1908.

Thalli mostly 1-2 cm long and 3-4 mm wide, dichotomously branched, sometimes with apical innovations, green above, purplish brown beneath and sometimes along the margin. Vein forming a rounded keel beneath. Margin wavy, purplish brown, not incurved when dry. Ventral scales purplish, large, imbricate, lunate, appendaged; appendages single or paired, subulate, acuminate, entire. Dorsal epidermis without oil cells; its cells 20 x 24 μ, thin walled throughout or somewhat showing trigones. Air

[75]pī lō' sä.

chambers sparingly divided by supplementary walls; green tissue loose. Pores slightly elevated, surrounded by 5-7 radiating rows of 2-3 cells each; the radiating walls of these cells scarcely thickened. Ventral tissue occupying about ⅓ the cross section in the median region of the thallus. Thalli bisexual. Antheridial receptacles sessile, small, clearly defined, with



Mannia pilosa. 1, Ventral view, (*a*) antheridial branch, (*v*) ventral scale, (*f*) female receptacle, x 20. 2, Dorsal view, x 20. 3, Cross section of thallus, (*c*) chambers, x 150. 4, Spore, outer face, x 200. 5, Pore of thallus, x 340. 6, Vertical section of part of female disk, x 200. (5, after K. Mueller; the others after Massalongo.)

a few marginal bractlets, terminal usually on a short branch of a fork. Female receptacle stalked, on a short branch of a fork as is the male; stalk mostly 2.5-4 cm long, more or less purplish, with bractlets scattered along the whole length and denser clusters at top and bottom; disk mostly 2-2.5 mm wide, coarsely tuberculate, scarcely lobed, mostly with 3 archegonia. Elaters about 10 μ wide, with 3 spirals. Spores mostly 60-70 μ, yellowish brown; wing margin thick, undulate, about 5 μ wide; at least the outer face areolate, in profile apparently tuberculate; areolae fairly regular, coarse, mostly 8-10 μ wide. Name apparently from the hair-like bractlets on the stalk of the female receptacle.—On rocks in arctic and alpine regions.

ILLUSTRATIONS: Horneman, Fl. Dan. 8: pl. 1426, 1810; Massalongo, Atti Istit. Veneto 75: pls. 18 and 12, figs. 4-8, 1916; K. Mueller (409) 1: fig. 163. EXAMINA-

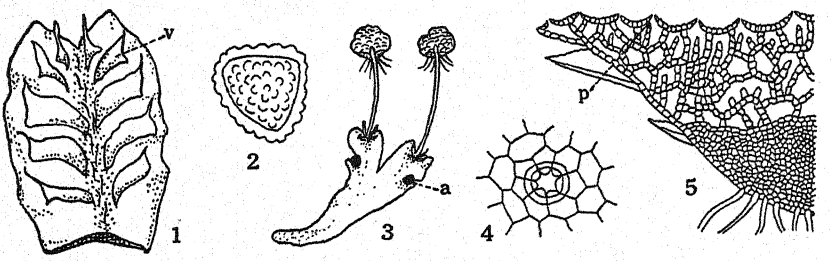
TIONS:—*Minn.* Winona (Holzinger) 1920; Carbon River in Lake County (Conklin 2470) 1925.—*B. C.* Stephens (Brinkman 818) 1913.

TYPE LOCALITY: Norway. RANGE: Greenland (409), Vt. (198), Que. (162), Wis. (98), Alta. (51), Alaska (90), B. C. (51); Asia (409); Eur. (325).

4. **Mannia sibirica**[76] (K. Muell.) n. comb.

Grimaldia pilosa var. *sibirica* K. Muell., Rabenhorst Krypt.-Fl. 6 (1) :265, 1907. *Neesiella sibirica* Massal., Atti Instit. Veneto 73 (2) :928, 1914.

Thalli up to 10 mm long, 1-3 mm wide, much lobed and cleft, firm, almost leathery, copperish to purplish red, only the youngest parts green; under side dark purple. Cross section triangular, the photosynthetic tissue constituting half its thickness. Ventral scales purplish red, with 1 appendage. Epidermal cells rather thick walled, slightly thickened in the angles, higher than wide, sharply defined from the second layer of cells, smaller than in *M. pilosa*. Air chambers with supplementary walls, with occasional filaments which end in larger oval cells; their roof plane. Pore simple, surrounded by 6-8 radiating rows of 3 cells each. Disk of the female receptacle yellowish green, concave above, with very shortly lobed margin, papillose above, with 3-4 archegonia beneath, stalked; stalk 15 mm long, about 500 μ thick at base, dark red, with many white hair-like scales below and a few above. Elaters up to 300 μ long and 15 μ wide, strongly attenuate at the ends; spirals 3, narrow, pale yellow. Spores 51-60 μ, light yellow, translucent, with wide wing margin, areolate with strongly crenulate lamellae. Otherwise as in *M. pilosa*. Distinguishable from *M. pilosa* chiefly by the firm leathery thallus and the thick epidermis, together with the somewhat smaller and lighter spores. Named from Siberia, where it was first found.—On soil in southern exposures.



Mannia sibirica. 1, Portion of thallus, ventral view, (*v*) ventral scale, x 20. 2, Spore, outer face, x 133. 3, Plant with female receptacles and (*a*) antheridial ones, x 1.3. 4, Pore of thallus, x 100. 5, Portion of cross section of thallus, (*p*) photosynthetic filament, x 53. (All after Massalongo.)

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 19, 1916. EXAMINATIONS: None.

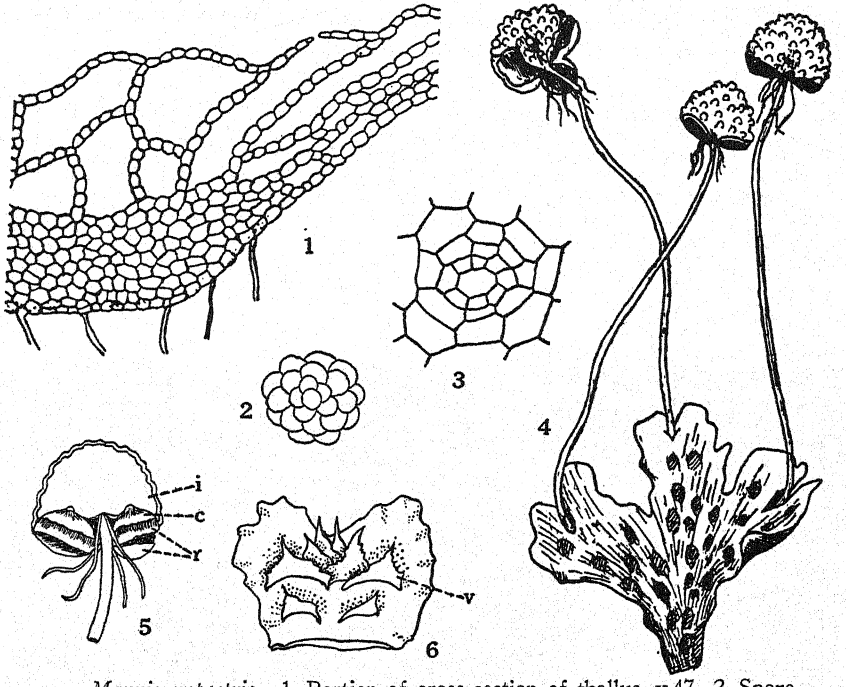
TYPE LOCALITY: Makokovo, between Krasnoyansk and Jeniseik, (Arnell) 1876. This is approximately lat. 57° N., long. 170° E. RANGE: Northern N. Amer. (325); Siberia (325); northern Europe (325).

[76]sī bĭ′ rĭ kă.

5. Mannia rupestris[77] (Nees) n. comb.

Duvalia rupestris Nees, Mag. Gesell. Nat. Freunde Berlin 8:271, 1817.
Grimaldia rupestris Lindenb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14: Suppl. 108, 1829.
Neesiella rupestris Schiffn., Engler & Prantl Nat. Pfl.-Fam. 1 (3) 1: 33, 1893.

Thalli mostly 1-2 cm long and 2-3 mm wide, dichotomously and occasionally ventrally branched, usually green throughout, sometimes slightly pigmented below. Vein forming a broad rounded keel beneath. Margin



Mannia rupestris. 1, Portion of cross section of thallus, x 47. 2, Spore, outer face, x 167. 3, Young pore of thallus, x 213. 4, Plant with female receptacles, x 8. 5, Female receptacle, (*c*) calyptra, (*i*) involucre, (*r*) ruptured sporangium, x about 12. 6, Ventral view of portion of thallus, (*v*) ventral scale, x 20. (2, 6, after Massalongo; 1, 3, 4, after K. Mueller; 5, after Schiffner.)

thin, undulate, not incurved when dry. Ventral scales often somewhat colored, small, ovate, appendaged; appendages 1-2, subulate, mostly 150-300 μ long and 60-90 μ wide, entire, acute to acuminate. Dorsal epidermis with scattered oil cells; its cells averaging about 16 x 22 μ, thin walled throughout or with more or less distinct trigones. Air chambers sparingly divided by supplementary partitions; walls 1 cell thick; green tissue loose. Pores slightly elevated, surrounded by 6-8 radiating rows of cells of 2-3 each.

[77] rū pĕs' trĭs.

Ventral tissue occupying about ⅓ the thickness of the thallus in the median region. Thalli bisexual. Antheridial receptacles terminal, usually on a short branch of a fork, sessile, small, clearly defined, with very few marginal bractlets. Female receptacles on a short branch of a fork similar to the antheridial ones, stalked; stalk mostly 1-3 cm long, naked or with a few linear bractlets at base and apex; disk mostly 2-3 mm wide, coarsely tuberculate, scarcely lobed, mostly with 3 archegonia. Elaters mostly 8-9 μ wide, with 2-3 somewhat coalescent spirals, yellowish brown. Spores mostly 55-65 μ, yellowish brown, appearing tuberculate in profile; wing margin thick, undulate, about 4 μ wide; outer face indistinctly punctulate, areolate; areolae coarse, fairly regular, mostly 10-12 μ wide; inner faces similar to the outer or not areolate. L. *rupestris,* of rocks; referring to its habitat.—On rocks and the humus in their crevices; calciphile.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 17, 1916; K. Mueller (409) 1: figs. 164-165; Schiffner (458) figs. 11A, 17 G-K; Meylan (386) fig. 29; Bischoff, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17: pl. 68, fig. 3, 1835. EXAMINATIONS:—*Vt.* Brandon (Dutton) 1922.—*Ohio.* Springfield (Biddlecombe) 1877.—*Minn.* Winona (Holzinger 60) 1888; Stockton (Holzinger) 1906.

TYPE LOCALITY: Germany. RANGE:[78] Vt. (203), Que. (178), N. Y. (171), Ont. (373), Ohio (513), Ill. (162), Wis. (98), Minn. (198), Mo. (198); Asia (198); Eur. (386).

CRYPTOMITRIUM[79] Aust., Underw. in Bull. Ill. State Lab. Nat. Hist. 2:36, 1884.

Platycoaspis Lindb., Lindb. & Arn. in Kgl. Sv. Vet.-Akad. Handl. 23 (5) :11, 1889.

Thalli perennial, dichotomous, sometimes with ventral branches and apical innovations, often green throughout, sometimes somewhat purple below, delicate. Gemmae none. Upper surface showing polygonal areas corresponding with the air chambers beneath. Ventral scales in 2 rows, with appendages. Dorsal epidermis distinct, 1 cell thick; cells thin walled, without trigones. Air chambers sparingly subdivided by supplementary partition and thus apparently somewhat in 2 layers; green filaments wanting; green tissue loose. Pores simple, surrounded by radiating rows of thin walled cells. Ventral tissue composed of thin walled cells, without oil cells, without sclerenchymatous cells. Thalli unisexual. Antheridia forming a narrow median dorsal group posterior to the female receptacle; ostioles inconspicuous. Female receptacle terminal, stalked; stalk naked, with 1 rhizoid furrow, without green tissue; disk thin, soon becoming circular and slightly convex above, not lobed, its pores barrel-shaped; archegonia in 3-7 radiating groups of 3-4 each. Involucre deeply 2-lipped, extending about half way to the margin; pseudoperianth wanting. Sporo-

[78]Evans (202) p. 112, says reports of *Mannia rupestris* for California are to be referred to *Cryptomitrium tenerum.*

[79]krȳp″ tō mit′ rĭ ŭm.

phyte of sporangium with seta and foot. Seta very short; foot bulbous. Sporangium with a distinct lid which remains intact in dehiscence, the wall one cell thick except near apex. Elaters mostly with 2 spirals. Spores tetrahedral, brown, wing margined, the faces lamellose. Name from Gk. *kryptos,* concealed and *mitrion,* a turban; in reference to the inconspicuous involucre.

The characters separating *Mannia* from *Cryptomitrium* are doubtfully of generic value. The former has the antheridia on a separate branch or plant, and has an unlobed pseudoperianth; the later has the antheridia posterior to the archegonial branch and has a deeply lobed pseudoperianth.

1. **Cryptomitrium tenerum**[80] (Hook.) Aust., Underw. in Bull. Ill. State Lab. Nat. Hist. 2:36, 1884.

Marchantia tenera Hook., Kunth Syn. Pl. 1:45, 1822.
Duvalia gayana Mont., Ann. Sci. Nat., Ser. 3, 4:354, 1845.
Duvalia tenera Gottsche, G. L. & N. Syn. Hep. 554, 1846.
?Duvalia brevipedunculata Mont., G. L. & N. Syn. Hep. 555, 1846.
Platycoaspis tenera Lindb., Lindb. & Arn. in Kgl. Sv. Vet.-Akad. Handl. 23 (5): 11, 1889.

Thalli mostly 0.5-1.5 cm long and 3-9 mm wide. Vein forming a rounded narrow ventral keel. Margin very thin, undulate-repand or crenate, not incurved when dry. Ventral scales with filiform appendages. Dorsal epidermis without oil cells; its cells averaging about 25 x 35 μ. Pores surrounded by 8 rows of radiating cells with 2-3 cells in each row. Ventral tissue largely restricted to the keel. Female receptacle with stalk mostly 1.5-3 cm long; disk about 5 mm wide. Elaters mostly 7-11 μ wide, with 2-3 close spirals in the middle. Sporangium subspheric. Spores mostly 30-50 μ; faces irregularly reticulate. L. *tener,* delicate; apparently referring to the female receptacle.—On moist shaded banks.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pls. 93-94, 1899; Clark and Frye (81) 17, figs. 1-14. EXAMINATIONS:—*Wash.* Elwha River Valley (Frye) 1906; Snoqualmie Pass (Frye) 1922.—*Cal.* Fairfax in Marin County (Sutliffe) 1930; Tuna Canyon in Verde Hills of Los Angeles County (MacFadden) 1931.

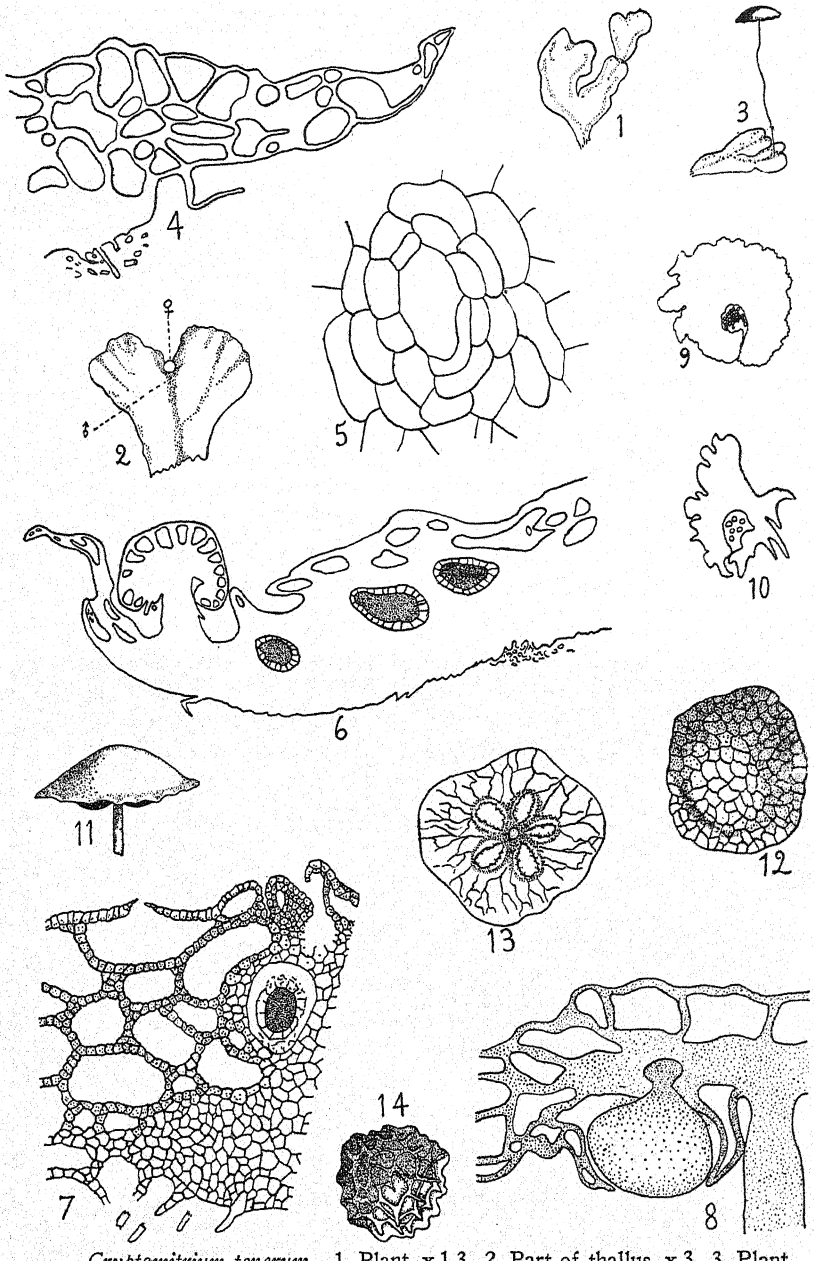
TYPE LOCALITY: Ario, Michoakan, Mexico (Humboldt). This is about lat. 19° 8′ N., long. 101° 46′ W. RANGE: Wash. (81), Cal. (292); Mex. (224); S. Amer. (458).

ASTERELLA[81] Beauv. Dict. Sci. Nat. 3:257, 1805.

Fimbraria[82] Nees Horae Physicae Berol. 45, 1820.
Hypenantron Corda, Opiz, Beitr. 648, 1829.
Rhacotheca Bisch., Seubert Fl. Azor. 12, 1844.
Octoskepos Griff. Not. Pl. Asiat. 2:343, 1849.

Thalli perennial, at first dichotomous, later often also with ventral branches, usually more or less purplish, firm to delicate. Gemmae none. Ventral scales appendiculate, in 2 longitudinal rows. Dorsal epidermis

[80] tĕ′ nĕ rŭm.
[81] ăs tĕr ĕl′ lă.
[82] This was later spelled *Fimbriaria* and is in common use, but *Asterella* antedates it. Further, *Fimbriaria* Stackh., Mem. Soc. Moscow 2:95, 1809, was once a genus of algae (now *Odonthalia*) 11 years before it was used in hepaticae.



Cryptomitrium tenerum. 1, Plant, x 1.3. 2, Part of thallus, x 3. 3, Plant with female receptacle, x 1. 4, Part of cross section of thallus, x 23. 5, Pore of thallus, x 225. 6, Longitudinal vertical section of thallus showing female receptacle and antheridia, x 26. 7, Part of cross section of thallus showing one antheridium, x 41. 8, Longitudinal section of female receptacle showing one sporophyte, x 28. 9, Cross section of stalk of young female receptacle, x 25. 10, Cross section of stalk of old female receptacle, x 70. 11, Female receptacle, x 4. 12, Dorsal view of female receptacle, x 4. 13, Ventral view of female receptacle, x 4. 14, Spore, outer face, x 351. (All after Howe.)

distinct, 1 cell thick, colorless or pale green, with scattered oil cells; its cells with thin or thick walls, with or without trigones. Air chambers sometimes undivided, sometimes divided by supplementary walls; green filaments none; walls 1 cell thick; green tissue loose to compact. Pores simple, surrounded by 4-8 radiating rows of 2-5 cells each, the radial walls sometimes distinctly thickened. Ventral tissue sometimes with oil cells, parenchymatous, without sclerenchymatous cells, with or without pitted cells, with scattered oil cells, rarely with slime cells. Thalli unisexual or bisexual. Antheridial receptacles sessile, more or less distinct, or the antheridia merely in acropetal succession in an irregular median group, their associated epidermal pores simple. Female receptacles terminal, stalked; stalk with 1 rhizoid furrow, without green tissue; disk flat to strongly convex or conic, smooth to coarsely tuberculate, slightly to strongly lobed, its pores compound; archegonia usually single, rarely in short rows, beneath the lobes. Involucre membranous, undivided to bilabiate, entire or nearly so; pseudoperianth conspicuous, tubular, membranous, white to purple, inflated, contracted at mouth, soon splitting into 3-20 narrow segments which usually remain attached at their tips. Sporophyte composed of the sporangium with seta and foot. Seta short; foot bulbous. Sporangium with wall 1 cell thick except near tip, opening by a clearly defined lid, without a definite suture; wall cells without annular thickenings, sometimes with trigones. Elaters with 1 or more spirals; spores tetrahedral; wing margin present; faces ridged or otherwise marked.—Name the diminutive of Gk. *aster,* a star; referring to the star-like appearance of the pores in some species, due to the thickened radial walls.

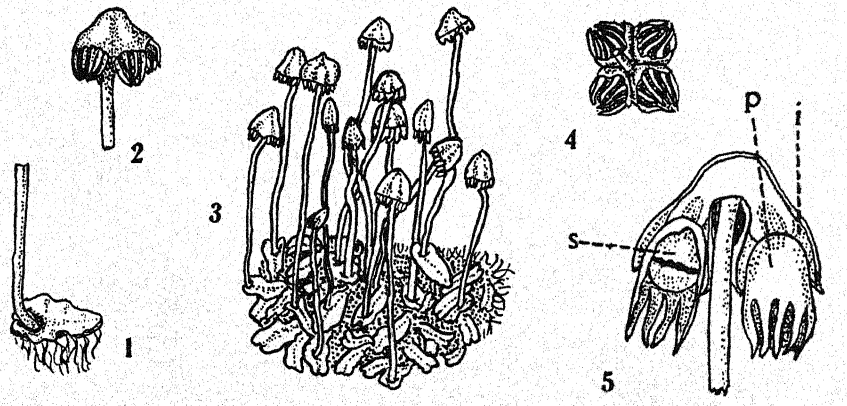
A. Branching largely or wholly dichotomous even at maturity.
  B. Dorsal air chambers not subdivided by supplementary partitions.
    C. Cells with oil bodies present in the epidermis; segments of the pseudoperianth becoming free with age; spores yellow, coarsely reticulate.
      D. Female receptacle distinctly lobed, smooth or nearly so; spores mostly 80-90 μ, the meshes of their faces 16-18 μ ..... 1. *A. tenella.*
      DD. Female receptacle scarcely lobed, covered with low and coarse tubercles; spores mostly 60-65 μ, the meshes of their faces 9-12 μ ..... 2. *A. ludwigii.*
    CC. Cells with oil bodies lacking in the epidermis; segments of the pseudoperianth remaining attached; spores dark brown to nearly black, not reticulate ..... 3. *A. palmeri.*
  BB. Dorsal air chambers more or less subdivided by supplementary partitions.
    E. Margins of the thallus strongly incurved when dry; plants xerophytic.
      F. Appendages of the ventral scales 1-2, forming a conspicuous white cluster at the tip of the thallus; plants bisexual; faces of the spores without ridges; spores 80-90 μ ..... 4. *A. saccata.*

FF. Appendages of the ventral scales mostly 2-4, not forming a conspicuous white cluster at the tip of the thallus; plants unisexual; faces of the spores coarsely ridged; spores mostly 100-120 μ..... 5. *A. californica.*
EE. Margins of the thallus not or hardly incurved when dry; plants not xerophytic..... 6. *A. lindenbergiana.*
AA. Branching largely or wholly ventral at maturity; dorsal air chambers subdivided by numerous supplementary partitions.
G. Margins of the thallus not or hardly incurved when dry; plants not xerophytic; upper side of female receptacle densely rough with tubercles 500-1000 μ long..... 7. *A. echinella.*
GG. Margins of thallus incurved when dry; plants xerophytic; upper side of female receptacle smooth or with very low tubercles..... 8. *A. bolanderi.*

1. Asterella tenella[83] (L.) Beauv. Dict. Sci. Nat. 3:257, 1805.

Marchantia tenella L. Sp. Pl. 1137, 1753.
Fimbriaria tenella Nees Horae Physicae Berol. 45, 1820.
Fimbriaria nigripes Bisch., Lehm. Stirp. Pug. 6:19, 1834.
Fimbriaria tenella var. *porphyrocephala* Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17:1023, 1835.
Fimbriaria tenella var. *brachypus* G. L. & N. Syn. Hep. 563, 1846.
Fimbriaria brachypus Mont., G. L. & N. Syn. Hep. 563, 1846, as synonym.
Fimbriaria mollis Tayl., London Jour. Bot. 5:411, 1846.
Hypenantron tenellum Trev., Mem. Istit. Lomb. 13:440, 1877.
Hypenantron molle Trev., Mem. Istit. Lomb. 13:441, 1877.

Thalli mostly 0.5-1.5 cm long and 1.5-3 mm wide, branching almost invariably dichotomous, bright green, often purplish along margins and beneath. Gemmae none. Vein constituting a rounded ventral keel. Margin thin, undulate, purplish. Ventral scales appendiculate; appendages 1-2, narrowly to broadly ovate, mostly 250-450 μ long and 150-300 μ wide,



Asterella tenella. 1, Thallus with stalk of receptacle, x 2. 2, Female receptacle, x about 3. 3, Plant, x 1. 4, Under side of female receptacle, x about 3. 5, Longitudinal section of female receptacle, (*i*) involucre, (*p*) pseudoperianth, (*s*) sporangium opening, x about 6. (All after Schiffner.)

[83] tĕ nĕl' lă.

acute to rounded, entire or somewhat dentate. Dorsal epidermal cells averaging about 25 x 40 μ, their walls slightly thickened, sometimes with distinct trigones. Air chambers not subdivided by supplementary partitions; green tissue loose. Pores 1 per chamber, slightly or not at all elevated, surrounded by about 6 radiating rows of 2-3 cells each; radial walls about the pore thin. Antheridial receptacle hardly distinct, sessile, the antheridia merely a group anterior to the female receptacle. Female receptacles stalked; stalk naked, often purple, about 2 cm long; disk 2-4 mm wide, hemispheric, smooth or nearly so, shortly lobed; its lobes mostly 4, extending obliquely downward. Involucre deeply 2-lipped, entire to irregularly sinuate or crenate; pseudoperianth mostly 8-10 cleft, white or yellowish to purplish; the segments finally free, ovate to lanceolate. Sporangium with lid which remains intact at dehiscence. Elaters mostly 10-12 μ wide, yellow, with 2 spirals in the middle and one at the ends. Spores mostly 80-90 μ, yellow; wing margins undulate, 8-15 μ wide; outer face reticulate, with fine irregular lines and coarse ridges, the meshes 16-18 μ wide; inner faces similar but the reticulations incomplete. L. *tenellus*, slender; probably referring to the thallus in comparison with that of *Marchantia*.—On wet banks, damp ground in sandy fields, and on damp rocks in the lowlands.

ILLUSTRATIONS: Bischoff, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17: pl. 69, fig. II, 1835; Sullivant, Mosses of the U. S., pl. 6, 1856; Schiffner (458) figs. 18A-E. EXAMINATIONS:—*R. I.* Providence (Collins 1850) 1899.—*Conn.* Hartford (Conklin & Lorenz 2407) 1924.—*Vt.* Brandon (Dutton 1270) 1921.—*N. Y.* Stiles (Fisher 205) 1889.—*Pa.* Funch Creek (Knout) 1910.—*Ohio.* Hocking County (Taylor) 1922.—*Ky.* Carter's Caves (Fulford) 1932.—*W. Va.* Fairmount (Boutlou) 1916. —*Va.* Great Falls (Mary F. Miller) 1907.—*N. C.* Flat Rock (Schallert) 1923.—*Ga.* Thomasville (Brown) 1923.

TYPE LOCALITY: Virginia. RANGE:[84] Me. (140), N. H. (142), Vt. (142), N. Y. (58), Ont. (198), Pa. (513), Ohio (513), Ind. (513), Ill. (513), Mo. (212), Neb. (204), Ark. (192), Okla. (353), Tex. (354), La. (192), Miss. (192), Ala. (192), Ga. (52), S. C. (513), Tenn. (513), N. C. (43), Ky. (218), Va. (198), Md. (192), D. C. (343), Del. (513), N. J. (192), Conn. (212), R. I. (140), Mass. (513).

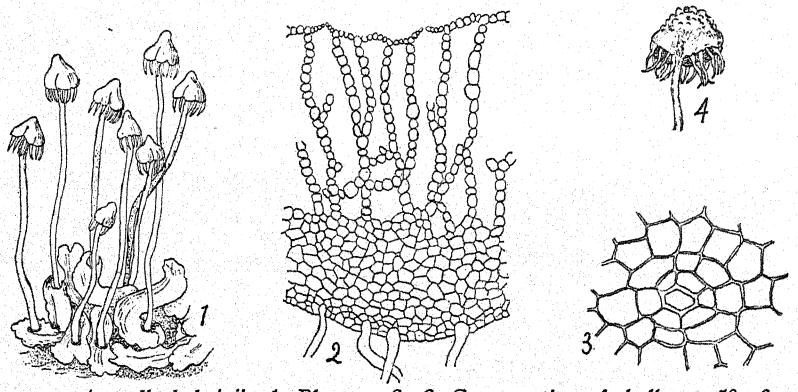
2. **Asterella ludwigii**[85] (Schwaegr.) Underw., Bot. Gaz. 20:61, 1895.

Marchantia tenella of Retz. Fl. Scand. Prodr., Ed. 2, 270, 1795; not of L. Sp. Pl. 1137, 1753.
Marchantia polycephala Schleich. Cat. Pl. Helv. Ed. 2, 31, 1807, the name only.
Marchantia pilosa of Wahl. Fl. Lapp. 399, 1812; not of Hornem. Fl. Dan. 8:7, 1810.
Marchantia ludwigii Schwaegr., Hist. Musc. Hep. Prodr. 33, 1814.
Marchantia gracilis F. Weber, Hist. Musc. Hep. Prodr. 195, 1815.
*Fimbriaria** *tenella* Nees Horae Physicae Berol. 45, 1820, in part.
Fimbriaria nana Lindenb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14: Suppl. 109, 1829.

[84]We consider the reports of its occurrence in Alaska, British Columbia and California as probably due to error.
[85]lūd wi' gi ī.
*See footnote 92, page 83.

Marchantia nana Schleich., Lindenb. in Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14: Suppl. 110, 1829, as synonym.
Fimbriaria pilosa Tayl., Trans. Linn. Soc. 17:386, pl. 13, fig. 3, 1837.
Fimbriaria schleicheriana Corda, Nees Naturg. Eur. Leberm. 4:273, 1838, as synonym.
Dictyochiton pilulare Corda, Nees Naturg. Eur. Leberm. 4:280, 1838, as synonym.
Fimbriaria gracilis Lindb., Not. Saellsk. Fauna et Fl. Fennica 10:282, 1868.
A. pilosa Trev., Rend. Istit. Lomb. II, 7:785, 1874.
Fimbriaria ludwigii Limpr., Cohn Krypt.-Fl. Schlesien 1:340, 1876.
Hypenantron gracile Trev., Mem. Istit. Lomb. 13:440, 1877.
Hypenantron nanum Trev., Mem. Istit. Lomb. 13:440, 1877.
Hypenantron pilosum Kuntze, Revue Gen. 89, 1891.
A. gracilis Underw., Bot. Gaz. 20:61, 1895.
Fimbriaria macounii Steph., Bull. Herb. Boissier 7:99, 1899.

Thalli mostly 0.5-1.5 cm long and 1-2 mm wide, of fertile plants often 3-5 mm wide, dichotomous, green, often purplish along margins and beneath. Vein constituting a rounded ventral keel. Margin thin, undulate,



Asterella ludwigii. 1, Plants, x 2. 2, Cross section of thallus, x 50. 3, Pore of thallus, x 170. 4, Female receptacle, x 2.45. (All after K. Mueller.)

purplish. Ventral scales appendiculate; appendages 1-2, lanceolate to ovate, mostly 200-600 μ long and 150-300 μ wide, mostly acute to acuminate, rarely blunt, entire or nearly so. Dorsal epidermal cells averaging about 20 x 25 μ; walls usually slightly thickened, with more or less distinct trigones; oil cells few, scattered. Air chambers not divided by supplementary walls, each with a pore; green tissue loose. Pores slightly elevated, surrounded by about 6 radiating rows of 2 cells each. Thalli bisexual. Antheridial disk not well developed; antheridia in a small group anterior to the female receptacle. Female receptacle stalked; stalk naked or with a few scattered bractlets, often purple, mostly 2-3 cm long; disk about 2 mm wide, hemispheric, covered with low tubercles; its lobes usually 3, scarcely evident, extending obliquely downward. Involucre narrow, entire or nearly so; pseudoperianth hyaline, mostly 8-cleft; the segments soon becoming free, narrowly lanceolate; lid remaining intact at

dehiscence. Elaters mostly 8-10 μ wide, yellow, usually with 2-3 spirals in the middle and 2 at the ends. Spores 60-65 μ; wing margins 6-10 μ wide, undulate; outer face minutely and often indistinctly punctulate, covered with coarse ridges which usually form a reticulum; meshes 9-12 μ wide; inner faces like the outer but less distinctly marked and less frequently reticulate. Apparently named in honor of Karl Ludwig, who gathered cryptogamic plants in southern Germany early in the 19th century.—Arctic and alpine; on banks and rocks.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 13, 1916; Clark & Frye (81) 20, figs. 1-4; K. Mueller (409) 1: fig. 168; Gil (76) fig. 154; Taylor, Trans. Linn. Soc. Bot. 17: pl. 13, fig. 3, 1837. EXAMINATIONS:—*Minn.* Big Falls (H. C. and L. R. Wilson 2487) 1925.—*Wyo.* Veedawoo Glen in Albany County (Porter 1749) 1935.—*Mont.* In Glacier Nat. Park at Logan Pass (Frye) 1934.—*B. C.* Ravelstoke (Taylor 105) 1921.—*Ida.* Gibbonsville (Frye) 1929.—*Wash.* Headwaters of Queets River (Frye) 1907; Gate (Foster 2018) 1912.—*Ore.* Mt. Hood (Frye) 1934; Cornucopia (Rakestraw) 1935.—*Cal.* Placerville (Eastwood) 1927.

TYPE LOCALITY: European. RANGE: Greenland (320), Mass. (5), N. Y. (506), Que. (162), Minn. (96), Mo. (506), Neb. (204), Colo. (175), Utah (192), Wyo. (446), Mont. (81), Alta. (192), Alaska (455), B. C. (373), Ida. (82), Wash. (81), Ore. (81), Cal. (202); Iceland (458); Asia (315); Eur. (329); Canary Isl. (325).

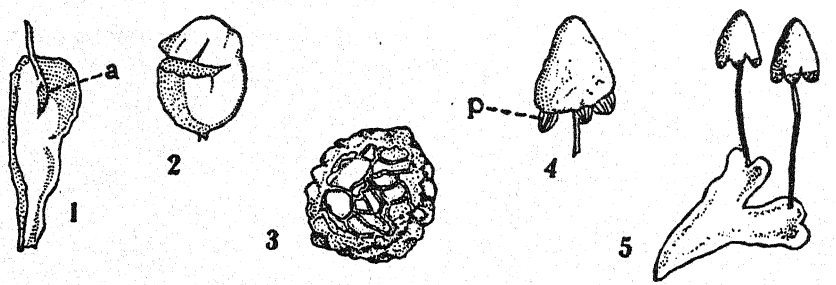
3. Asterella palmeri[86] (Aust.) Underw., Bot. Gaz. 20:63, 1895.

Fimbriaria palmeri Aust., Bull. Torr. Bot. Club 6:47, 1875.
Fimbriaria nudata Howe, Erythea 1:112, 1893.
A. nudata Underw., Bot. Gaz. 20:61, 1895.

Thalli mostly 0.5-1 cm long and 2-4 mm wide, dichotomously branched, green above, more or less purplish along margin and beneath. Vein a rounded ventral keel. Margin undulate, crisped, somewhat scarious, becoming strongly incurved when dry. Ventral scales appendiculate; appendages 1-2, narrowly to broadly subulate, mostly 500-900 μ long and 100-250 μ wide, acuminate, entire to sparingly dentate. Dorsal epidermal cells averaging about 25 x 35 μ, thin walled, without trigones; oil cells not present. Air chambers not subdivided by supplementary partitions; those of the dorsal layer vertically elongate, each with a pore. Green tissue compact. Pores elevated, surrounded usually by 6 radial rows of 2 cells each, the cells bounding the opening with more or less thickened radial walls. Ventral tissue compact, of thin walled cells without pits. Thalli bisexual. Antheridial receptacle indistinct, sessile; antheridia in a small group anterior to the female receptacle. Female receptacle stalked; stalk naked, mostly 1-2 cm long, more or less brownish; disk obtusely conic, about 4 mm high and 2.5-4 mm wide, smooth or nearly so, scarcely lobed. Involucre entire or nearly so, narrow; pseudoperianths mostly 3-4, extending vertically downward, white, 8-12-cleft; the segments connate at tip, lanceolate. Sporangium with lid which remains intact in dehiscence.

[86]păm′ ĕr ī.

Elaters mostly 12-14 μ wide, pale brown to dark brown, usually with 2 spirals in the middle but sometimes with only 1 throughout. Spores 60-80 μ in diameter, dark brown to almost black; wing margin undulate, about



Asterella palmeri. 1, Thallus with part of stalk of female receptacle and (*a*) antheridial receptacle, x 3. 2, Sporangium, opening, x 12. 3, Spore, outer face, x 225. 4, Female receptacle, (*p*) pseudoperianth, x 4. 5, Plant, x 2. (All after Howe.)

5 μ wide; faces with undulate folds or with mere ridges or tubercles, sometimes also obscurely punctulate; the folds or ridges interwoven but not forming a reticulum. Named in honor of Dr. Edward Palmer who first found the plant.—On banks in sunny places.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 99, figs. 1-15, 1899. EXAMINATIONS:—*Cal.* Pasadena (Kingman) 1910; Altadena (Kingman 1205) 1911; San Diego (Haynes 2792) 1927; Fairfax (Sutliffe) 1928.

TYPE LOCALITY: Gaudalupe Island, off Lower California, about lat. 29° 3′ N. and long. 118° 20′ W. (Dr. Edward Palmer). RANGE: Cal. (335), N. Mex. (272); Gaudalupe Isl. (296).

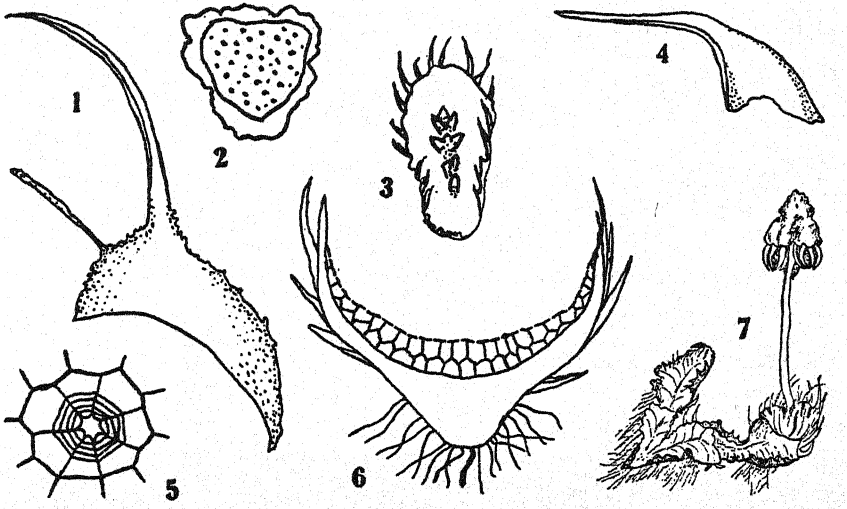
4. **Asterella saccata**[87] (Wahl.) Evans, Contrib. U. S. Nat. Herb. 20:276, 1920.

Marchantia fragrans of Schleich. Pl. Crypt. Exsic. Helvet. 3:64, 1804, hyponym; DC. Fl. Fr. 2:423, 1805. Not of Balbis, Mem. Acad. Turin 7:76, 1804.
Marchantia saccata Wahl., Mag. Gesell. Nat. Freunde Berlin 5:296, pl. 7, fig. 3, 1811.
Fimbriaria saccata Nees Horae Physicae Berol. 45, 1820.
Fimbriaria fragrans Nees Horae Physicae Berol. 45, 1820.
Hypenantron ciliatum Corda, Opiz, Beitr. 648, 1829, the name only.
Marchantia umbonata Wallr., Linnaea 14:686, 1840.
Fimbriaria umbonata Wallr., G. L. & N. Syn. Hep. 559, 1846.
A. fragrans Trev., Rend. Istit. Lomb., Ser. 2, 7:785, 1874.
Hypenantron fragrans Trev., Mem. Istit. Lomb. 13:440, 1877.
Hypenantron umbonatum Trev., Mem. Istit. Lomb. 13:440, 1877.
Hypenantron saccatum Trev., Mem. Istit. Lomb. 13:440, 1877.

Thalli mostly 0.5-1 cm long and 2-3 mm wide, dichotomously branched, green in the middle above, more or less purple at margins and beneath. Vein a rounded or bluntly angled ventral keel. Margin purplish,

[87] sāk kā′ tā.

undulate, strongly incurved when dry. Ventral scales appendiculate; appendages 1-2, sometimes more or less connate, subulate, mostly 700-1000 μ long and 200-300 μ wide, long acuminate, the margin entire to sparingly and irregularly dentate or spinose-dentate, hyaline, forming a dense apical cluster. Dorsal epidermal cells averaging about 20 x 30 μ; their



Asterella saccata. 1, Ventral scale of thallus, x 100. 2, Spore, outer face, x 200. 3, Portion of thallus with male receptacle, x 8. 4, Ventral scale from apex of thallus, x 100. 5, Pore of thallus, x 200. 6, Cross section of thallus, x 60. 7, Plant with female receptacle, x 2. (7, after Janzen; the others after Massalongo.)

walls more or less thickened, with distinct trigones; oil cells few, scattered. Air chambers subdivided by supplementary walls, apparently more numerous than the pores; green tissue fairly loose. Pores more or less elevated, surrounded by about 6 radial rows of 2-3 cells each; the walls radiating from the pores thin or with trigones. Ventral tissue thin walled, without pits. Thalli bisexual. Antheridial receptacles not clearly differentiated, sessile; antheridia dorsal, median in an elongate group, anterior to the female receptacle, or on a separate branch. Female receptacle stalked; stalk about 2 cm long, more or less colored, naked except for a dense cluster of scales at base; these scales hyaline, lanceolate; disk bluntly conic, about 3 mm wide, shortly 3-4-lobed, the lobes extending almost vertically downward, the upper surface with low tubercles. Involucre entire to sinuate; pseudoperianth white, mostly 8-cleft; the segments connate at their tips, lanceolate. Sporangium with lid which remains intact at dehiscence. Elaters mostly 10-14 μ wide, yellowish brown, either with 2-3 spirals in the middle or with 1 spiral throughout. Spores 80-90 μ, yel-

lowish brown; wing margins undulate, 10-12 μ wide; faces finely and often regularly reticulate through delicate lines, otherwise smooth or with occasional low folds or tubercles which never form a reticulum; meshes about 2 μ wide. It is not clear to us to what part of the plant the name *saccata* refers.—On soil among rocks; alpine and arctic; calciphile.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 16, 1916; Clark & Frye (81) 22, figs. 1-2; Bischoff, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17: pl. 69, fig. III, 1835; Schiffner (458) figs. 18F-H; Gil (76) fig. 153. EXAMINATIONS:—*Minn.* Winona bluffs (Holzinger) 1901.—*Mont.* Swiftcurrent trail in Glacier Nat. Park (Frye) 1928.—*Wyo.* Telephone Canyon in Albany County (Porter 1748) 1935. —*Ore.* Cornucopia (Rakestraw) 1935; Crater Lake (Rakestraw) 1935.

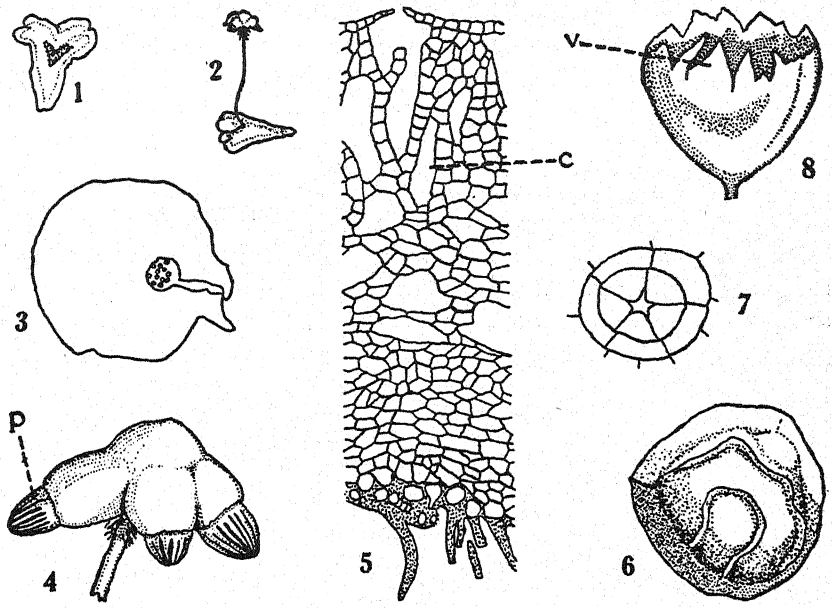
TYPE LOCALITY: Kamchatka. RANGE: Wyo. (446), Mont. (81), Yukon (192), Alaska (491), B. C. (51), Ida. (81), Wash. (81), N. Mex. (296); Mex. (377); Asia (350); Eur. (410).

5. Asterella californica[88] **(Hampe) Underw., Bot. Gaz. 20:60, 1895.**

Sauteria limbata Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869):229, 1870, in part.
Fimbriaria californica Hampe, Austin Hep. Bor.-Amer. 33, 1873.
Fimbriaria lescurii Aust., Hep. Bor.-Amer. 33, 1873, as synonym.
Clevea limbata Solms, Steph. in Bull. Herb. Boissier 6:773, 1898, in part.

Thalli mostly 1.5-2 cm long and 7-10 mm wide, dichotomously branched, in the middle above, more or less purplish along margins and beneath. Vein a ventral rounded keel. Margin undulate, purplish, more or less incurved when dry. Ventral scales appendiculate; appendages mostly 2-4, usually narrowly subulate, mostly 600-900 μ long and 80-150 μ wide, acuminate, entire or with a sharp tooth or lobe. Dorsal epidermal cells averaging about 30 x 50 μ, thin walled, sometimes with minute trigones; oil cells few, scattered. Air chambers somewhat subdivided by vertical supplementary partitions and thus apparently more numerous than the pores; green tissue rather loose. Pores slightly elevated, surrounded usually by 6 radiating rows of 3 cells each, the walls radiating from the pores more or less thickened. Ventral tissue of thin walled cells without pits, with occasional slime cells. Thalli unisexual. Antheridial receptacle not well differentiated, sessile; antheridia dorsal, median, in an elongate or forked cluster; bractlets occasionally present. Female receptacle stalked; stalk naked or nearly so, brownish or purplish, 1-3 cm long; disk green, depressed-hemispheric, about 5 mm wide, almost smooth, deeply lobed; the lobes usually 4, extending obliquely outward. Involucre split almost to base, entire or shallowly toothed; pseudoperianth white or rarely purplish, mostly 12-16-cleft; the segments connate at their tips, lanceolate. Sporangium with lid which breaks into fragments at dehiscence. Elaters mostly 12-16 μ wide, yellow, with 1-2 spirals in the middle but

[88]kăl ĭ fôr' nĭ kă.



Asterella californica. 1, Thallus with antheridial receptacle, x 1. 2, Thallus with female receptacle, x 1. 3, Cross section of stalk of young female receptacle, x 41. 4, Female receptacle with mature sporophyte, (*p*) pseudoperianth, x 4. 5, Portion of median vertical longitudinal section of thallus, (*c*) chamber, x 48. 6, Spore, outer face, sometimes with more ridges, x 225. 7, Pore of thallus, dorsal view, x 305. 8, Sporangium after dehiscence, (*v*) valve, x 12. (All after Howe.)

only 1 at the ends. Spores mostly 100-120 μ; wing margins undulate, 12-20 μ wide; faces finely and often irregularly reticulate, also with a few wide rounded irregular ridges; reticulations 3-4 μ wide. Name from the state in which it was first found.—On open or lightly shaded banks, often about rocks.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 95-96, 1899. EXAMINATIONS:—*Cal.* Santa Catalina Island (Kingman 820) 1910; Tuna Canyon in Los Angeles County (MacFadden 7148) 1931; Santa Cruz (J. T. Howell 69) 1931; Bella Vista (Frye 2090) 1933; Marsh Creek road in Contra Costa County (Carter 264) 1933.

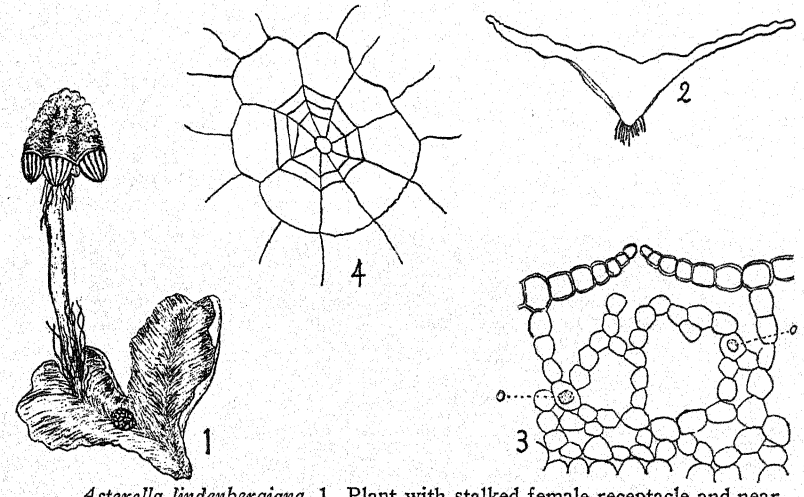
TYPE LOCALITY: California. RANGE: Ore. (457), Cal. (296), Ariz. (184); Guadalupe Island off the Lower Californian coast of Mexico (296).

Underwood (513) reports its occurrence in B. C., but Evans (192) throws doubt upon this.

6. Asterella lindenbergiana[89] (Corda) Lind. Musc. Scand. 1, 1879.

Fimbriaria lindenbergiana Corda, Nees Naturg. Eur. Leberm. 4:283, 1838.
Fimbriaria maior Hampe, Nees Naturg. Eur. Leberm. 4:283, 1838, as synonym.
Marchantia alpina Schleich., Nees Naturg. Eur. Leberm. 4:283, 1838, as synonym.
Fimbriaria bonjeanii DeNot., Mem. Accad. Sci. Torino II, 1:335, pl. 1, fig. e, 1839.
A. bonjeanii Trev., Rend. Istit. Lomb. II, 7:785, 1874.
Hypenantron bonjeanii Trev., Mem. Istit. Lomb. 13:440, 1877.
Hypenantron lindenbergiana Kuntze, Revue Gen. 89, 1891.
Fimbriaria commutata Steph., Bull. Herb. Boissier 7:202, 1899.

Thalli mostly 1-3 cm long and 4-6 mm wide, dichotomously branched, sometimes green above but usually purplish on both sides. Dorsal groove shallow. Vein a sharp narrow ventral keel. Margin thin, undulate-crispate, somewhat incurved when dry. Ventral scales appendiculate; appen-



Asterella lindenbergiana. 1, Plant with stalked female receptacle and near it a stalkless antheridial receptacle, x 2.5. 2, Outline of cross section of thallus x 7.5. 3, Longitudinal vertical section through pore, (*o*) oil bodies, x 1.05. 4, Pore, x 360. (4, after Meylan; the others after K. Mueller.)

dages mostly 1-2, rarely 3, lanceolate, mostly 250-400 μ long and 80-120 μ wide, acute to acuminate, entire or nearly so. Dorsal epidermal cells averaging about 25 x 35 μ, thin walled, without trigones; oil cells few, scattered. Air chambers sparingly subdivided by supplementary partitions, and thus apparently more numerous than the pores; green tissue fairly loose. Pores slightly elevated, surrounded usually by 7-8 radiating rows of 3-4 cells each; the walls radiating from the pores slightly thickened. Ventral tissue with walls slightly thickened and pitted. Thalli bisexual. Antheridial receptacles sessile, not well differentiated, anterior to the female receptacle or on a separate branch; antheridia median, dorsal,

[89] lĭn″ dĕn bĕrg ĭ ā′ nă. Lindberg's spelling was *A. lindenbergii.*

in an oval cluster. Female receptacle stalked; stalk deeply colored, about 2 cm long, with a loose cluster of bractlets at base and apex; disk bluntly conic, 3-4 mm wide, with low tubercles; lobes short, 3-4, extending obliquely downward. Involucre narrow, bilobed, entire or nearly so; pseudoperianth usually deep purple, mostly 12-16-cleft; the segments connate at tip, lanceolate. Elaters mostly 12-16 μ wide, purple, with 2 spirals throughout or with only one at the ends. Spores mostly 80-100 μ, dark purple; wing margin undulate, often loose, 10-14 μ wide; faces with a fine reticulum, otherwise without markings; meshes 4-6 μ wide. Named in honor of J. B. G. Lindenberg, a German botanist.—On wet soil, at high altitudes.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 15, 1916; Clark & Frye (81) 21, figs. 1-4; K. Mueller (409) 1: figs 8, 16, 169; Meylan (386) fig. 30. EXAMINATIONS:—*Wyo.* Plumbago Canyon in Albany County (Porter 949) 1931.—*Mont.* In Glacier National Park along Iceberg Lake Trail (Frye) 1928; Logan Pass (Frye) 1929 and (Rakestraw) 1934.—*Alta.* Pharob (Brinkman 983) 1913; Healy Creek (Brinkman 936) 1913.—*Wash.* Headwaters of Elwha River (Frye) 1907; Port Angeles (Frye) 1927.—*Ore.* Ashland (Wells) 1929; Crater Lake (Rakestraw) 1935; Ice Lake in Wallowa Mts. (Rakestraw) 1935.

TYPE LOCALITY: Salzburg, Austria. RANGE: Wyo. (445), Mont. (81), Alta. (192), Alaska (192), B. C. (192), Wash. (80), Ore.; Mex. (458); S. Amer. (458); Eur. (409).

7. Asterella echinella[90] (Gottsche) Underw., Bot. Gaz. 20:62, 1895.

Fimbriaria echinella Gottsche, Danske Vid. Sellsk. Skr. V. 6:367, 1863.

Thalli mostly 1-2 cm long and 2-4 mm wide, rarely dichotomously branched, the branches nearly always ventral, green or more or less colored along margin and on ventral side. Vein a rounded ventral keel. Margin green or somewhat colored, undulate, scarcely or not incurved when dry. Ventral scales appendiculate; appendages 1-2, narrowly subulate, mostly 600-900 μ long, acuminate, entire or nearly so. Dorsal epidermal cells averaging about 25 x 50 μ, with slightly thickened walls, without trigones; oil cells few, scattered. Air chambers with crowded vertical supplementary partitions; green tissue compact. Pores elevated, surrounded by 6-8 radiating rows of 3 cells each. Ventral tissue with more or less thickened and pitted walls. Thalli bisexual. Antheridial receptacles terminal on a more or less elongate branch, sometimes with an apical innovation, oval to obcordate, fringed with narrow bractlets. Female receptacles on a short to somewhat elongate branch, stalked; stalk not colored, mostly 1-1.5 mm high, with scattered slender bractlets and a denser apical cluster; disk hemispheric, mostly 2-3 mm wide, normally 4-lobed, upper surface tuberculate; lobes short, distinct; tubercles crowded, blunt, 0.5-1 mm long. Pseudoperianth white or purplish, mostly 8-10-

[90] ĕk ĭn ĕl′ lā.

cleft; the segments connate at the tips, lanceolate. Sporangium with a lid which remains intact in dehiscence. Elaters mostly 12-14 μ wide, pale brown to dark brown, sometimes with 2 spirals in the middle, sometimes with 1 spiral throughout. Spores mostly 60-100 μ, pale brown to dark brown; wing margin 8-10 μ wide; faces coarsely and usually regularly reticulate, also minutely and irregularly punctulate; meshes 15-20 μ wide. Diminutive of L. *echinus,* a hedgehog; referring to the densely almost spiny-tuberculate female receptacle.—On rocks and banks.

ILLUSTRATIONS: None. EXAMINATIONS: None.

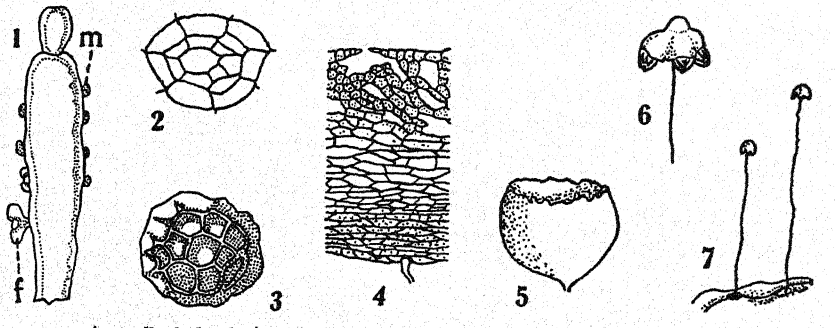
TYPE LOCALITY: Orizaba, Vera Cruz, Mexico. RANGE: Ark. (491), Tex. (192); Mex. (192).

Sullivant (498), Underwood (504) and Massalongo (377) refer to *Asterella elegans* Trev. (*Fimbriaria elegans* Spreng.) as occurring in the United States, but it seems probable that this is due to its closeness to *A. echinella. A. elegans* is in Mexico; more evidence is needed before including it among the liverworts of the U. S. and northward.

8. **Asterella bolanderi**[91] (Aust.) Underw., Bot. Gaz. 20:61, 1895.

Fimbriaria bolanderi Aust., Proc. Acad. Nat. Sci. Philadelphia 21 (1869):320, 1870.
Fimbriaria violacea Aust., Bull. Torr. Bot. Club 3:17, 1872.
A. violacea Underw., Bot. Gaz. 20:61, 1895.

Thalli mostly 1-2 cm long and 2-4 mm wide, branching usually ventral but rarely dichotomous, green in middle above, more or less purplish marginally and ventrally. Vein a rounded ventral keel. Margin undulate,



Asterella bolanderi. 1, Thallus with the small (*m*) male and (*f*) female latero-ventral innovations, x 3. 2, Pore, x 225. 3, Spore, outer face, x 225. 4, Median longitudinal section of thallus, x 47. 5, Sporangium open, x 12. 6, Female receptacle, x 4. 7, Plant, x 1. (All after Howe.)

purplish, strongly incurved when dry. Ventral scales appendiculate; appendages 1-2, narrowly lanceolate or subulate, mostly 500-750 μ long and 100-150 μ wide, acuminate, entire or nearly so. Dorsal epidermal cells

[91]bō lăn' dĕr ī.

averaging about 28 x 40 μ, with somewhat thickened walls, with minute trigones; oil cells few, scattered. Air chambers divided by crowded vertical supplementary partitions; green tissue compact. Pores elevated, surrounded by 7-8 radiating rows of 3 cells each; the walls radiating from the pore slightly thickened. Ventral tissue thick walled, pitted. Thalli bisexual. Antheridial receptacle sessile, without marginal bractlets, small and not well defined, terminal on a very short branch; the branch slightly expanded, subclavate. Female receptacle stalked, on a short branch, the branch ventral in origin, short, expanded, emarginate or obcordate; stalk more or less purple, with bractlets; the bractlets scattered but also comprising a dense apical cluster, slender, mostly 1-3 cm long; disk hemispheric to bluntly subconic, mostly 2.5-4 mm wide, smooth or with very low tubercles, normally 4-lobed; the lobes short, distinct. Pseudoperianth white or more or less purplish, mostly 12-16-cleft; the segments connate at the tips, lanceolate. Sporangium with lid which breaks into fragments in dehiscence. Elaters mostly 8-12 μ wide, yellow to brown, sometimes with 2 spirals throughout but usually with only one at the ends. Spores mostly 65-100 μ; wing margin undulate, 8-12 μ wide, reticulate; faces coarsely and regularly reticulate, also minutely and irregularly punctulate; meshes 12-20 μ wide. Named in honor of Henry Bolander, who first found it.—On banks not densely shaded.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pls. 97-98, 1899. EXAMINATIONS:—*Cal.* Antioch in Contra Costa County (T. S. Brandegee) 1889; White's Hill in Marin County (Sutliffe) 1932; Napa (Carter 447) 1932; Santa Barbara (G. Alcorn) 1935.—*Tex.* Leon Springs (Frye) 1931.

TYPE LOCALITY: San Rafael, California (Bolander) 1866. RANGE:[92] Tex., Cal. (296).

REBOULIA[93] G. L. & N. Syn. Hep. 547, 1846.

Asterella Beauv., Lam. Encycl. Meth. Suppl. 1:502, 1810, in part.
Rebouillia[94] Raddi, Opusc. Sci. Bologna 2:357, 1818.
Strozzia S. F. Gray, Nat. Arr. Brit. Pl. 1:682, 1821.
Rhakiocarpon Corda, Opiz, Beitr. 648, 1829.
Achiton Corda, Opiz, Beitr. 649, 1829.
Otiona Corda, Opiz, Beitr. 649, 1829.

Thalli perennial, dichotomous and also with apical innovations, firm in texture, more or less purple. Gemmae none. Upper surface only indistinctly showing polygonal areas. Air chambers more or less divided by supplementary partitions and thus apparently in more than one layer,

[92]Underwood (Zoe 1:365, 1891) gives *Fimbriata tenella* Nees from California, and *Fimbriata violacea* Aust. from California and British Columbia. We consider the spelling *Fimbriata* merely an error. Probably the reports of *Asterella violacea* from British Columbia are based upon Macoun (373) and it seems more likely that the material from B. C. was *A. saccata.*

[93]re bu' li ă.

[94]According to G. L. & N. Syn. Hep. 547, 1846, the spelling was *Rebouillia.* Raddi's work is not available to us. We know of no one using *Rebouillia* since 1846, and it has the priority. However, *Reboulia* is nearer the man's name, shorter, and 90 years of usage in its favor. It should be made formally one of the *nomena conservanda.*

their walls 1 cell thick; green filaments none; green tissue rather loose. Ventral tissue with more or less thickened and pitted walls but none sclerenchymatous, without oil cells. Ventral scales in 2 rows, with appendices. Dorsal epidermal cells in 1 layer, colorless or pale, thin walled, with distinct trigones, oil cells wanting. Pores simple, surrounded by 6 or more radiating rows of cells with thickened radial walls. Thalli unisexual or bisexual. Antheridial receptacles well defined, becoming dorsal; antheridia in acropetal succession; male branch often continuing its growth or innovating. Female receptacle terminal, stalked, the branch often innovating when fertilization fails; stalk with 1 rhizoid furrow, without green tissue; disk strongly convex, distinctly lobed, with compound pores; archegonium usually 1 under each lobe. Involucre 2-lipped; pseudoperianth wanting. Sporophyte composed of sporangium with seta and foot. Seta short. Sporangium of 1 layer of cells except near tip. Elaters with 2 or more spirals. Spores tetrahedral, with anastomosing surface folds. Named in honor of E. de Reboul, a botanist of Florence, Italy.

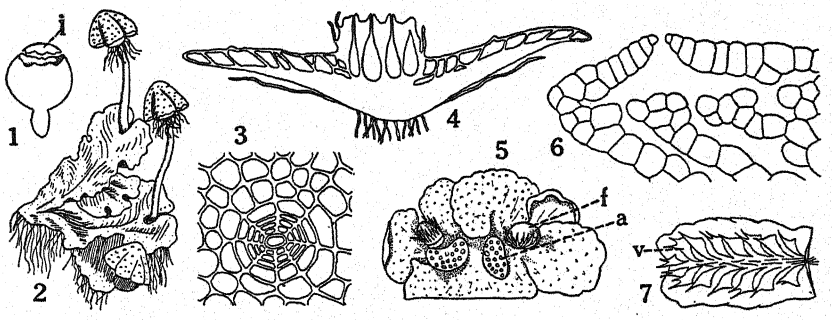
1. Reboulia hemisphaerica[95] (L.) G. L. & N. Syn. Hep. 548, 1846.

Marchantia hemisphaerica L. Sp. Pl. 1138, 1753.
Marchantia crinita Michx. Fl. Bor. Amer. 2:276, 1803.
Asterella hemisphaerica Beauv., Dict. Sci. Nat. 3:257, 1805.
Marchantia barbata Link, Weber Hist. Musc. Hep. Prodr. 104, 1805, as synonym.
Rebouillia hemisphaerica Raddi, Opusc. Sci. Bologna 2:357, 1818.
Strozzia hemisphaerica S. F. Gray Nat. Arr. Brit. Pl. 1:682, 1821.
Achiton quadratum Corda, Opiz, Beitr. 649, 1829.
Otiona crinita Corda, Opiz, Beitr. 649, 1829.
Grimaldia hemisphaerica Lindenb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14: Suppl. 106, 1829.
Marchantia fasciata Myrin, Lindenb. in Flora 16:174, 1833.
Grimaldia madeirensis Lindenb., Flora 16:175, 1833.
Fegatella hemisphaerica Tayl., Trans. Linn. Soc. 17:383, 1835.
Grimaldia ventricosa Wallr., Linnaea 14:688, 1840.
R. fasciata Nees, G. L. & N. Syn. Hep. 549, 1846.
R. javanica Nees, G. L. & N. Syn. Hep. 549, 1846.
Fegatella microcephala Tayl., London Jour. Bot. 5:410, 1846.
R. microcephala Nees, G. L. & N. Syn. Hep. 790, 1847.
R. sullivantii Lehm. Stirp. Pugil. 10:24, 1857.
R. longipes Sande-Lacoste, Ann. Mus. Bot. Lugd.-Bat. 3:209, 1867.
Asterella hemisphaerica var. *fasciata* Lindb., Not. Saellsk. Fauna et Fl. Fennica 9:286, 1868.
Asterella fasciata Trev., Mem. Istit. Lomb. 13:439, 1877.
Asterella microcephala Trev., Mem. Istit. Lomb. 13:439, 1877.
Asterella javanica Trev., Mem. Istit. Lomb. 13:439, 1877.
R. hemisphaerica var. *paroica* Massal. & Carest., Massal. in Ann. Istit. Bot. Roma 2:53, 1886.
R. hemisphaerica var. *longilanata* Lindb. & Arn., Sv. Vetens.-Akad. Handl. 23 (5):14, 1889.
Asterella longipes Mitt., Trans. Linn. Soc., Ser. 2, 3:205, 1891.
R. hemisphaerica var. *macrocephala* Massal., Sommier Fl. Giglio 118, 1898.

[95] hĕm" ĭ sphēr' ĭk ă.

R. hemisphaerica var. *javanica* Schiffn., Denks. Akad. Wien 67:155, 1898.
R. hemisphaerica var. *microspora* Schiffn., Oesterr. Bot. Zeitsch. 58:228, 1908.
R. occidentalis Douin, Revue Gen. Bot. 30:144, 1918.
R. charrieri Douin, Revue Gen. Bot. 30:144, 1918.

Thalli mostly 1-3 cm long and 6-7 mm wide, usually green in middle region and brownish purple along the sides and beneath. Vein constituting a narrow roundish keel. Margin thin, undulate, scarcely or not at all incurved when dry. Dorsal epidermis without oil cells; its cells averaging about 30 x 50 μ, the trigones usually bulging into the cells. Pores elevated, the radiating rows about them usually of 4-5 cells each. Ventral



Reboulia hemisphaerica. 1, Sporophyte, (*l*) lid, x 40. 2, Plant with female receptacles, x 1. 3, Pore of thallus, x 140. 4, Cross section of thallus through antheridial receptacle, x 8. 5, Plant, (*a*) antheridial receptacle, (*f*) female receptacle, x about 3. 6, Portion of vertical section through pore and air chamber, x 175. 7, Portion of thallus, ventral view, (*v*) ventral scale, according to Massalongo x 10, but probably more nearly x 2 or 3. (6, after Leitgeb; 5, after Pearson; 1, 7, after Massalongo; the others afer K. Mueller.)

tissue largely restricted to the keel. Appendages of the ventral scales 2-3, narrowly linear-lanceolate or linear, mostly 700-900 μ long and 60-100 μ wide, long acuminate, entire, composed of larger cells than the rest of the scale. Thalli unisexual or bisexual. Antheridial receptacle sometimes at the base of the stalk of the female receptacle, sometimes terminating a separate branch, oval to broadly lunate, often deep purple, sometimes with a few slender marginal bractlets. Female receptacle stalked; the stalk with a cluster of slender bractlets at base and at apex, mostly 1.5-3 cm long, more or less colored below; disk mostly 3-4 mm wide. Sporangium green. Elaters yellow, mostly 10-12 μ wide, with 2-3 spirals. Spores mostly 60-80 μ, yellow or yellowish brown; wing-margin undulate, 6-10 μ wide; faces minutely punctulate, coarsely and rather regularly reticulate; reticulations mostly 16-20 μ wide. The name in reference to the hemispheric female receptacle.—On rocks, walls and earth.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 22, 1916; Pearson (433) pl. 210; Sturm, Deutschl. Fl. Jungerm. pl. 19, 1798-1839; K. Mueller (409) 1: figs.

156-158; Schiffner (458) fig. 16; Warnstorf (523) 95, fig. 10; Gil (76) figs. 144, 150-151; Macvicar (374) 36, figs. 1-3; Underwood, Gray's Manual, Ed. 6, pl. 22, 1889; Leitgeb, Unters. Leberm. 6: pl. 3, figs. 12-23, 1881. EXAMINATIONS:—*Ind.* Fern (Underwood) 1892.—*Wash.* Mt. Angeles (Frye) 1927.—*Ore.* Eagle Creek (Reed College collection 27) 1922.—*Tex.* Handley (Ruth) 1914.—*Ala.* Opelike (Underwood & Cook 181) 1896.—*Fla.* Belleview (Underwood & Cook) 1891.—*N. C.* Winston-Salem (S. C. Anderson) 1922.

TYPE LOCALITY: European. RANGE: Me. (443), N. H. (142), Vt. (203), Mass. (140), R. I. (150), Conn. (212), N. Y. (58), Pa. (121), Ohio (396), Ind. (247), Ill. (426), Wis. (426), Iowa (469), Minn. (513), Man. (373), Neb. (204), Colo. (448), Alta. (51), B. C. (373), Wash. (81), Ore. (239), Cal. (296), Ariz. (184), N. Mex. (481), Tex. (354), Okla. (353), Mo. (513), Ark. (46), La. (513), Ala. (396), Fla. (337), Ga. (52), Tenn. (464), N. C. (43), Va. (271), Ky. (218), Md. (444), D. C. (343), N. J. (513); West Indies (338); Bermuda (146); Mex. (212); S. Amer. (409); Juan Fernandes (207); N. Z. (286); Australia (286); Borneo (221); Java (221); Sumatra (221); Formosa (286); Asia (387); Eur. (286); Africa (286); Tristan da Cunha (lat. 37° S., long. 10° W.) (391).

LUNULARIA[96] Adans. Fam. Pl. 2:15, 1763.

Dichominum Neck. Elem. Bot. 3:345, 1791, as hyponym. Trev., Rend. Istit. Lomb., Ser. 2, 7:785, 1874.
Staurophora Willd., Mag. Gesell. Nat. Freunde Berlin 3:101, 1809.

Thalli perennial, dichotomous and also with apical innovations, green or yellowish green. Gemmae in cups, discoid, with 2 opposite apical indentations; cups crescentic, entire. Upper surface showing polygonal areas. Ventral scales in 2 rows, appendiculate, membranous, with slime papillae. Dorsal epidermis colorless or nearly so, of 1 layer of cells, without oil cells. Air chambers in 1 layer; green filaments from the floors of the chambers, vertical, numerous, crowded, short, simple or branched, of rounded to cylindric cells; walls of chambers 1 cell thick. Pores simple, elevated, each surrounded by 6 or more radiating rows of 4-5 cells each. Ventral tissue parenchymatous, colorless, without slime cells, without sclerenchymatous cells, with scattered oil cells. Thalli unisexual. Antheridial receptacles sessile, terminal on a short branch; disk elevated, oval, flattish above, without pores, not lobed, the margin undulate; antheridia in acropetal succession in a broad median area. Female receptacle stalked; stalk colorless, without rhizoid furrow, the base surrounded by a cluster of crowded ovate scales; disk finally cruciate through its 4 finger-like involucres; archegonia in 4 short rows, each row normally resulting in only one sporophyte. Involucre membranous, tubular, with wide mouth; pseudoperianth lacking. Sporophyte consisting of sporangium with seta and foot. Seta 2-3 times as long as the sporangium; foot short. Sporangium oval; wall 1 cell thick except near tip; wall cells without thickenings; dehiscence by 4-8 irregular clefts from very near apex to near base and resulting in 4-8 lanceolate valves, the apical portion re-

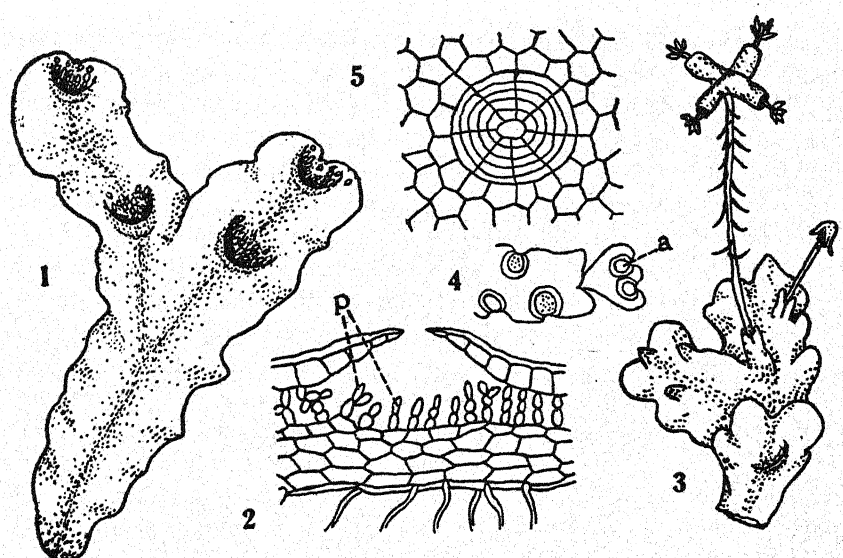
[96] lū nū lā' rĭ ă.

maining unbroken. Elaters long, narrow, with 2 spirals. Spores tetrahedral, yellowish, smooth. L. *lunularis,* like a little moon; in reference to the crescentic gemmae cups.

1. Lunularia cruciata[97] (L.) Dum. Comm. Bot. 116, 1822.

Marchantia cruciata L. Sp. Pl. 1137, 1753.
Staurophora pulchella Willd., Mag. Gesell. Nat. Freunde Berlin 3:101, 1809.
L. vulgaris Raddi, Opusc. Sci. Bologna 2:355, 1818.
Sedgwickia hemisphaerica Bowd., Excursions in Madeira and Porto Santo 4:35, 1830; not of Bisch. Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17:1079, pl. 70, fig. 4, 1835, which was *Plagiochasma rupestris.*
Preissia cucullata Mont. & Nees; Mont. in Ann. Sci. Nat., Ser. 2, 9:44, 1838.
L. michelii Le Jolis, Mem. Soc. Sci. Nat. Cherbourg 1:192, 1853.
L. dillenii Le Jolis, Mem. Soc. Sci. Nat. Cherbourg 1:192, 1853.
Dichominum cruciatum Trev., Rend. Istit. Lomb. II, 7:785, 1874.
Dichominum vulgare Trev., Mem. Istit. Lomb. 13:436, 1877.
Cyathophora cucullata Kuntze, Revue Gen. 834, 1891.
Marsilia cruciata Kuntze, Revue Gen. 837, 1891.

Thalli mostly 2-3 cm long and about 1 cm wide, brittle, thin or thick. Margin often somewhat crispate. Ventral scales appendiculate; appendages not or scarcely colored, orbicular to reniform, about 500 μ long, entire to vaguely crenulate. Dorsal epidermal cells averaging about 15-25 μ;



Lunularia cruciata. 1, Plant showing crescentic gemmae cups, x 3. 2, Vertical section of wing of thallus through pore, (*p*) photosynthetic filaments, x 150. 3, Plant with female receptacle, x 1. 4, Portion of male plant, (*a*) antheridial receptacles, x 1. 5, Pore of thallus, x 150. (2-5, after Massalongo.)

[97] "krū" shi ā' tă. So far as reported American material is without fruit, reproduction is by gemmae alone, except in the vicinity of San Diego, California. This suggests that the reason why sexual organs are not formed is climatic. It would be a good species with which to carry on experiments to determine the factors affecting the formation of sex organs.

walls slightly to strongly thickened, sometimes with distinct trigones. Ventral tissue with more or less distinctly pitted walls. Antheridial receptacle mostly 200-400 μ long. Female receptacle stalked; stalk colorless, 1.5-3 cm long, with fimbriate or dentate scales at its base; disk about 2 mm wide. Involucre about 2 mm long. Elaters mostly 5-8 μ wide. Spores tetrahedral, 15-20 μ, smooth, yellowish green. L. *cruciatus*, pertaining to a cross; referring to the 4 long involucres spreading in a cross-like manner.—Mostly on soil in greenhouses.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 10, 1916; Pearson (433) pl. 212; K. Mueller (409) 1: figs. 174-178; Warnstorf (523) 95, fig. 11; Macvicar (374) 40, figs. 1-6; Gil (76) figs. 141 Cc, 156. EXAMINATIONS:—*Utah.* Salt Lake City (Mrs. Mary Milner) 1934.—*Ida.* Moscow (Clark) 1926.—*Wash.* Seattle (Clark) 1928.—*Cal.* San Francisco (Sutliffe) 1931.

TYPE LOCALITY: European. RANGE: Me. (203), Vt. (140), Mass. (235), R. I. (169), Conn. (169), N. Y. (513), Pa. (338), Mich. (199), Iowa (469), Utah, Ida. (81), Wash. (81), Ore. (457), Cal. (471), N. C. (43), W. Va. (466), Md. (444), D. C. (343); West Indies (212); S. Amer. (212); Australia (458); Asia (212); Eur. (409); Bermuda (146); Atlantic Isl. (409); Africa (393).

CONOCEPHALUM[98] Wiggers Prim. Fl. Holsat. 82, 1780.

Fegatella Raddi, Opusc. Sci. Bologna 2:356, 1818.

Thalli perennial, dichotomous, green or purplish. Gemmae lacking; vegetative reproduction by apical or ventral tubers, or by minute deciduous branches. Upper surface showing distinct polygonal areas corresponding with the underlying chambers. Ventral scales in 2 rows, membranous, with slime papillae, appendiculate. Dorsal epidermis of 1 layer of cells or locally of 2, distinct, colorless or nearly so, without trigones, with few oil cells. Air chambers in 1 layer, not subdivided by supplementary partitions; green filaments many, crowded, simple or branched; their cells rounded with narrow bases, near the pores the end cells pear-shaped to linear; walls of chambers 1 cell thick. Pores elevated, simple, surrounded by 5-8 radiating rows of 5-6 cells each. Ventral tissue parenchymatous, colorless, with pitted walls, with some oil cells, with some slime cells, without sclerenchymatous cells. Thalli unisexual. Antheridial receptacles sessile, terminal on a short branch; disk oval or circular, not lobed, with barrel-shaped pores; antheridia in acropetal succession from the center, in 6-8 indefinite rows. Female receptacle stalked, terminal on a short branch; stalk long at maturity, with 1 rhizoid furrow, without green tissue; disk strongly convex, very shortly lobed, with barrel-shaped pores; lobes mostly 6-8, usually each with one archegonium. Involucre membranous, undivided, tubular, with narrow apical opening; pseudoperianth lacking. Sporophyte consisting of sporangium with seta

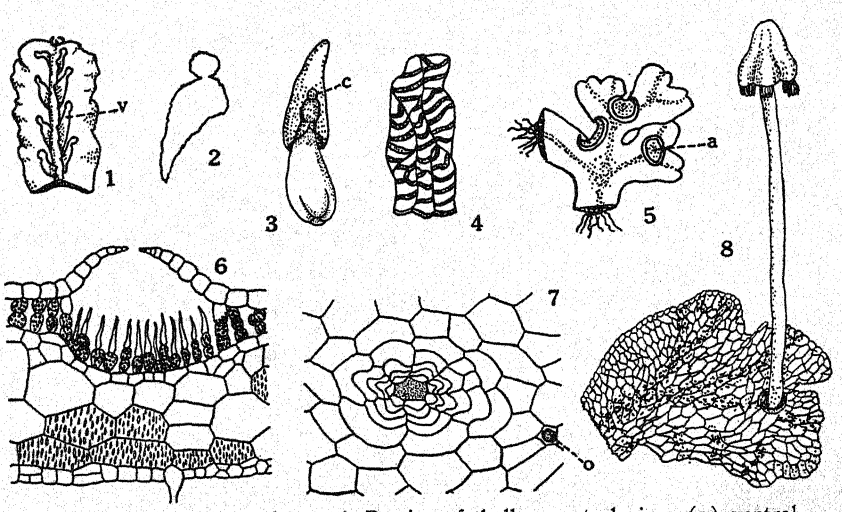
[98] kŏ" nō sĕf' ă lŭm. The spelling *Conocephalus* seems to have originated with Hill (Dumortier Comm. Bot. 115, 1822) and was widely used.

and foot. Seta short; foot not large. Sporangium ellipsoid or somewhat pyriform; wall 1 cell thick except apically, with annular thickenings; dehiscence by means of irregular clefts from near tip backward but not half way to base, leaving the apical portion intact. Elaters rather short, with 2 or more spirals. Spores tetrahedral and later ellipsoid, outer face densely verruculose. Name from Gk. *konos,* a cone, and *kephale,* a head; referring to the conical disk of the female receptacle.

1. **Conocephalum conicum**[99] (L.) Wiggers Prim. Fl. Holsat. 82, 1780.

Marchantia conica L. Sp. Pl. 1138, 1753.
C. trioicum Weber, Wiggers Prim. Fl. Holsat. 82, 1780.
Fegatella officinalis Raddi, Opusc. Sci. Bologna 2:356, 1818.
Strozzia conica S. F. Gray Nat. Arr. Brit. Pl. 1:682, 1821.
Fegatella conica Corda, Opiz, Beitr. 649, 1829.
Conocephalus nemorosus Hueben. Hep. Germ. 9, 1834.
Conocephalus vulgaris Bisch., Nova Acta Acad. Caes. Leop.-Carol Nat. Cur. 17:979, 1835.
Conocephalus officinalis Trev., Rend. Istit. Lomb., Ser. 2, 7:785, 1874.
Hepatica conica Lindb. Hep. Utveckl. 16, 1877.
Fegatella japonica Steph., Hedwigia 22:50, 1883.
Asterella kiaerii Kaalaas, Nyt. Mag. Naturvid. 33:78, 1893.
C. japonicum Schiffn, Engler & Prantl. Nat. Pfl.-Fam. 1 (3):35, 1893.

Thalli mostly 10-20 cm long and 1-2 cm wide, thin, firm, pale green to dark green, ventral surface often purplish. Tubers rarely produced,



Conocephalum conicum. 1, Portion of thallus, ventral view, (*v*) ventral scale, x 0.7. 2, Ventral scale of thallus, x 27. 3, Sporophyte, (*c*) calyptra, x 3.3. 4, Thickenings in wall of sporangium, x 100. 5, Portion of male plant, (*a*) antheridial receptacles, x 0.7. 6, Vertical longitudinal section through pore, x 133. 7, Pore of thallus, (*o*) oil cell, x 133. 8, Portion of plant with female receptacle, x 2.3. (3, after Pearson; 6-8, after K. Mueller; the others after Massalongo.)

[99] kŏn′ ĭk ŭm.

ventral, spherical, greenish or brownish, composed of parenchyma, covered with rhizoids. Upper surface with quite distinct polygonal areas with one pore each. Ventral scales appendiculate; appendages orbicular to reniform, mostly 300-500 μ long, entire, the marginal cells forming a more or less distinct border. Dorsal epidermal cells averaging about 30 x 100 μ. Air chambers with green filaments of which the end cells when near the pores are colorless and elongate or pyriform. Pores surrounded by several rows of cells with strongly out-curved walls. Ventral tissue of conspicuously pitted cells, with few large slime cells. Antheridial receptacle about 5 mm wide. Female receptacles stalked; stalk 5-10 cm long; disk about 5 mm high. Elaters irregular, sometimes branched, mostly 12-20 μ wide. Spores mostly 70-100 μ, ellipsoid, multicellular,[100] green. Name from Gk. *konos* a cone, referring to the conical disk of the female receptacle.—On damp soil or wet rocks, in damp air.

ILLUSTRATIONS: Massalongo, Atti. Istit. Veneto 75: pl. 9, 1916; Pearson (433) pl. 209; K. Mueller (409) 1: figs. 170-173; Bolleter, Beih. Bot. Centralb. 18: pls. 12-13 plus figs. 1-16, 1905; Cavers, Ann. Bot. 18: pls. 6-7, 1904; Macvicar (374) 38, figs. 1-3; Warnstorf (523) 95, fig. 9. EXAMINATIONS:—*N. C.* Winston-Salem (Schallert) 1922.—*Mass.* West Newberry (Haynes) 1902.—*N. Y.* Old Forge in Herkemer County (Haynes) 1903.—*S. Dak.* Lead (Frye) 1935.—*Mich.* Cheboygan County (Edith Wollett) 1923.—*Alta.* Crowsnest Pass (Frye) 1928.—*Alaska.* Ketchikan (Mrs. G. Willett) 1925; Cordova (Paul Thompson) 1933.—*Ida.* Meadows (Frye) 1929.—*Wash.* Seattle (Treen) 1909.—*Ore.* Port Orford (Frye) 1932.—*Cal.* Alton (Frye) 1933.

TYPE LOCALITY: European. RANGE: Newfoundland (513), N. S. (413), N. B. (373), Me. (443), N. H. (203), Vt. (169), Mass. (232), R. I. (140), Conn. (467), N. Y. (319), Que. (178), Ont. (373), Pa. (237), Ohio (513), Mich. (415), Ind. (247), Ill. (529), Wis. (98), Minn. (454), Iowa (88), Mo. (513), Neb. (204), Colo. (175), Wyo. (445), S. Dak., Mont. (81), Alta. (51), Alaska (135), B. C. (373), Ida. (81), Wash. (81), Ore. (81), Cal. (290), Ariz. (184), N. Mex. (481), Tex. (354), Okla. (463), Ark. (46), La. (396), Ala. (396), Fla. (337), Ga. (199), N. C. (43), Tenn. (464), Ky. (218), W. Va. (466), Va. (127), Md. (444), D. C. (343), Del. (513), N. J. (513); Asia (387); Eur. (32); Canary Isl. (325); Azores (409); Africa (32).

DUMORTIERA[101] Reinw. Bl. & Nees, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 7:410, 1824.

Hygropyla Tayl., Trans. Linn. Soc. 17:390, pl. 15, 1835.
Hygrophila Tayl., Mackay Fl. Hibern. 2:53, 1836.
Askepos Griffith Not. Pl. Asiat. 2:340, 1849.

Thalli perennial, dichotomously and also ventrally branched, dark green to yellowish green, not purplish. Gemmae lacking. Upper surface with polygonal areas wanting or barely discernable. Vein a keel, its ventral cells long and narrow. Ventral scales in 2 longitudinal rows, hyaline, rudimentary, without distinct appendages, with slime papillae. Dorsal epidermis not differentiated. Air chambers none or mere vestiges. Ven-

[100] The spores divide before escaping, so that the multicellular condition is really the result of the beginning of germination.
[101] du mor' ti er' ă.

tral tissue parenchymatous; oil cells occasionally present. Thalli unisexual or bisexual. Antheridial receptacles terminal, stalked; stalk very short, with 2 rhizoid furrows, without green tissue; disk oval to circular, flattish above, not lobed, under side with more or less numerous stiff bristles forming a peripheral fringe; pores lacking; antheridia in acropetal succession from center, not in distinct rows. Female receptacles stalked; stalks with 2 rhizoid furrows, without green tissue; pores wanting; disk flattish, often bristly above, shortly lobed; the lobes mostly 6-10, somewhat equally disposed, each bearing a row of archegonia but usually developing only one sporophyte. Involucre tubular, rather thick, hyaline, undivided, with a short apical split, bearing scattered bristles; pseudoperianth lacking. Sporophyte consisting of sporangium with seta and foot. Seta relatively short. Sporangium oval; wall of 1 layer of cells except in a small apical area, with annular thickenings. Dehiscence by means of irregular clefts from very near apex to near base and forming valves; valves 4-8, opening from apex back; the thickened apical portion remaining intact. Elaters long, slender, with 2 spirals. Spores small, indistinctly tetrahedral, without surface folds or lamellae, minutely tuberculate.—Named in honor of B. C. Dumortier, a French botanist.

Upper surface of the thallus with no or few papilliform outgrowths, glossy to somewhat velvety; boundaries of air chambers from not showing at all to distinct..... 1. *D. hirsuta.*
Upper surface of the thallus covered with papilliform outgrowths and thus velvety; boundaries of air chambers distinct..... 1a. var. *nepalensis.*

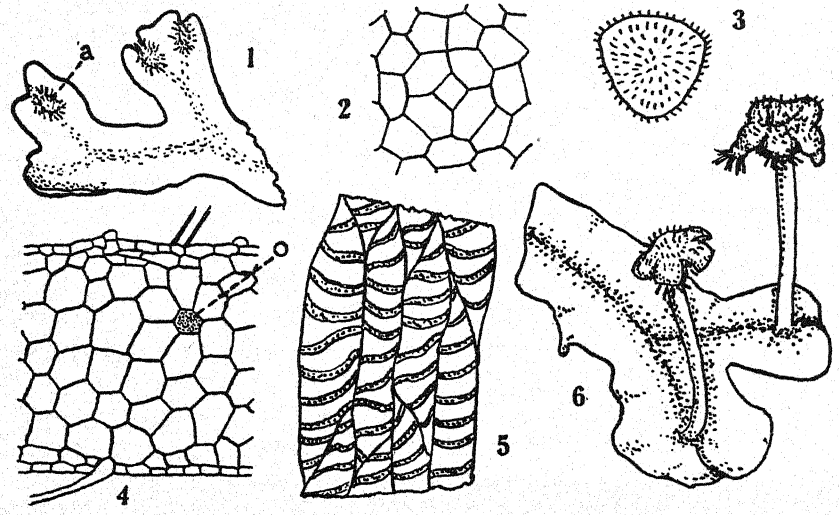
1. **Dumortiera hirsuta**[102] (Sw.) Reinw. Bl. & Nees, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 12:410, 1824.

Marchantia hirsuta Sw. Fl. Ind. Occ. Prodr. 145, 1788.
Marchantia irrigua Wils., Hook. Brit. Fl. 2:106, 1833.
Hygropyla irrigua Tayl., Trans. Linn. Soc. 17:390, 1835.
Hygrophila irrigua Tayl., Mackay Fl. Hibern. 2:54, 1836.
D. irrigua Nees Naturg. Eur. Leberm. 4:159, 1838.
D. hirsuta var. *angustior* G. L. & N. Syn. Hep. 544, 1846.
D. hirsuta var. *intermedia* G. L. & N. Syn. Hep. 544, 1846.
Askepos brevipes Griffith Not. Pl. Asiat. 2:340, 1849.
D. hirsuta var. *irrigua* Spruce, Trans. Bot. Soc. Edinburgh 15:566, 1885.

Thalli mostly 10-20 cm long and 1-2 cm wide. Upper surface smooth or nearly so, the boundaries of the evanescent air chambers sometimes visible as delicate anastomosing lines. Green tissue smooth, with superficial layer of small cells. Ventral tissue sometimes thin walled throughout, sometimes with more or less distinct pits, sometimes with collenchymatous thickenings, the cells containing starch grains except in the small-celled keel. Thalli usually unisexual, sometimes bisexual and then rarely

[102] hĭr sū′ tă.

with bisexual receptacles. Antheridial receptacles with disk about 5 mm wide, its upper surface smooth or with few bristles. Female receptacles with stalks 4-6 cm long; the disk mostly 800-900 μ wide, usually with



Dumortiera hirsuta. 1, Plant, (*a*) antheridial receptacles, x 1. 2, Pore of thallus, x 100. 3, Spore, x 150. 4, Vertical section of thallus, (*o*), oil cell, x 100. 5, Thickenings in wall of sporangium, x 150. 6, Plant with female receptacles, x 1. (4, after Casares-Gil; 6, after Kurz & Little; the others after Massalongo.)

marginal bristles only. Elaters 6-8 μ wide. Spores mostly 25-35 μ, reddish brown. L. *hirsuta,* hairy; referring to the bristly upper surface of the female receptacles.—On wet rocks and banks; calciphile.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 8, 1916; Pearson (433) pl. 213; Macvicar (374) 42, figs. 1-5; Underwood, Gray's Manual Ed. 6, pl. 22 in part, 1889; Gil (76) fig. 160; Kurz & Little, Bull. Florida State College for Women 26 (3): fig. 15, 1933. EXAMINATIONS:—*Fla.* Miernen (Mary A. Noble) 1917.—*N. C.* Tuckasegee Falls (Bloomquist) 1932.—*W. Va.* Wardenville (Ammons 204) 1930.—*Mo.* Glenco (Nelson) 1907.

TYPE LOCALITY: Jamaica. RANGE: Pa. (364), D. C. (343), W. Va., Ky. (218), Mo. (188), Okla. (354), Ark. (46), La. (504), Ala. (396), Fla. (337), Ga. (188), S. C. (188), Tenn. (464), N. C. (43); Bermuda (391); West Indies (188); Mex. (224); Guadalupe Isl. off Lower California (377); Central Amer. (188); S. Amer. (55); Hawaii (188); Tahiti (406); St. Thomas Isl. (377); P. I. (188); Asia (387); Eur. (458); Canary Isl. (364); Africa (388).

1a. Dumortiera hirsuta var. nepalensis[103] **(Tayl.) n. comb.**

Hygropyla nepalensis Tayl., Trans. Linn. Soc. 17:392, 1835.
Marchantia trichocephala Hook. Icon. Pl. pl. 158, 1837.
D. nepalensis Nees Naturg. Eur. Leberm. 4:169, 1838.
D. trichocephala Nees Naturg. Eur. Leberm. 4:499, 1838.
D. hirsuta var. *latior* G. L. & N. Syn. Hep. 544, 1846.
D. hirsuta var. *trichopus* Spruce, Trans. Bot. Soc. Edinburgh 15:567, 1885.
D. velutina Schiffn., Denks. Acad. Wien 67:156, 1898.
D. calcicola Campbell, Ann. Bot. 32:334, 1918.

Thalli 4-15 cm long and 4-12 mm wide, mostly dichotomous, sometimes with apical branches, slender, olive to brownish, not stiff, deep green above. Upper surface with crowded papilliform outgrowths giving a velvety appearance to the thallus. Rhizoids numerous. Ventral scales narrowly spatulate, inconspicuous. Dorsal epidermis with rather numerous papillate cells. Air chambers evident. Antheridial receptacles stalked; disk often distinctly 5-6-lobed, about 2 mm in diameter, quite bristly. Female receptacles stalked; stalk up to 3 cm long, naked; disk conic-hemispheric, about 2 mm in diameter, often somewhat 5-8-lobed; the upper surface little convex, rugulose, with scattered bristles over the whole surface even on its middle region; lobes convex, their margins rounded, separated by somewhat equal sinuses, emarginate at tip with a groove-like depression back of it. Involucre prominent. Spores about 34 μ. It was first found in Nepal, from whence the varietal name.—On wet rocks and banks.

ILLUSTRATIONS: Hooker Icon. Pl. pl. 158, 1837; Taylor, Trans. Linn. Soc. 17: pl. 15, fig. 2, 1836. EXAMINATIONS: None.

TYPE LOCALITY: Nepal. RANGE: Ga. (188), Fla. (188); West Indies (188); Mex. (224); Central Amer. (188); S. Amer. (188); Hawaii (220); Samoa (220); New Caledonia (87); P. I. (73); Borneo (73); Dutch E. Indies (220); Asia (387).

BUCEGIA[104] Radian, Bull. Herb. Inst. Bot. Bucarest 3-4:1, 1903.

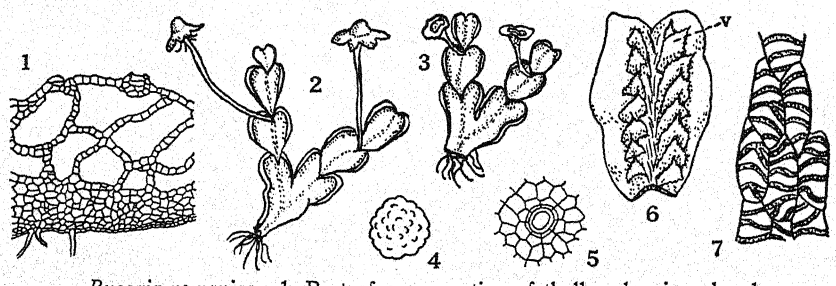
Thalli perennial, dichotomous, also with apical innovations, more or less purplish. Gemmae lacking. Upper surface showing distinct polygonal areas corresponding with the air chambers beneath. Ventral scales in 2 longitudinal rows, membranous, lunate, appendiculate, with slime papillae. Dorsal epidermis distinct, of 1 layer of cells, thin walled. Air chambers apparently in 2 or more layers; green filaments lacking; walls green, 1 cell thick. Pores barrel-shaped. Ventral tissue of parenchyma, without sclerenchymatous cells. Thalli unisexual. Antheridial receptacles stalked; stalks with 2-4 rhizoid furrows, without green tissue; disk flattish dorsally, with barrel-shaped pores above, not definitely lobed; antheridia in acropetal succession in rows from the central region. Female re-

[103] nĕ pal ĕn′ sĭs.
[104] bū kĕ′ ġĭ ă.

ceptacle stalked; stalks with 2-4 rhizoid furrows, without green tissue; disk convex dorsally, with barrel-shaped pores above, slightly lobed; each lobe bearing a group of archegonia which tend to be tangentially arranged, the group enclosed on the inside by an involucre. Involucre membranous, undivided, with margin crenulate. Pseudoperianth campanulate, abruptly contracted to its narrow tubular mouth, enclosing a single sporophyte. Sporophyte consisting of a sporangium with seta and foot. Seta short. Sporangium subspheric; its wall of a single layer of cells except a small apical area; cells of the wall with thickenings; thickenings C-shaped, sometimes coalescent; dehiscence by means of usually 4 irregular clefts from near tip backward and resulting in 4 valves, the thickened apical portion remaining intact and attached to one of the valves. Elaters long, slender. Spores tetrahedral, with narrow marginal folds and surface lamellae.—Named from the Bucegi Mountains in Romania, where the only species was first found.

Bucegia romanica[105] Radian, Bull. Herb. Inst. Bot. Bucarest 3-4:2, 1903.

Thalli mostly 2-3 cm long and 0.5-1 cm wide, usually green, purplish at margins and beneath or sometimes throughout. Vein making a sharp ventral keel. Margin purplish, plane to erect. Ventral scales large, purple, with slime papillae, without oil cells, appendiculate; appendages lanceolate, acuminate, subentire to sparingly and irregularly dentate. Dorsal



Bucegia romanica. 1, Part of cross section of thallus showing chambers and a pore, x 63. 2, Plant with female receptacles, x 0.67. 3, Plant with antheridial receptacles, x 0.67. 4, Spore outer face, x 133. 5, Pore, x 67. 6, Portion of thallus, ventral view, (*v*) ventral scale, x 4. 7, Thickenings in wall of sporangium, x about 133. (1, after Haynes; the others after Massalongo.)

epidermis without trigones or oil cells. Pores with a cruciate inner opening. Ventral tissue without slime cells or oil cells. Antheridial receptacles terminal or dorsal, stalked; stalk 0.5-1 cm long, with 2 rhizoid furrows close together; disk mostly 200-300 μ wide. Female receptacles stalked; stalk 1-2 cm long; disk about 500 μ wide, usually 4-lobed. Elaters about

[105] rd mär' i ka.

8 μ wide, with 2-3 spirals. Spores 45-50 μ, reddish brown. Surface with lamellae which sometimes form an indistinct reticulum. Named after the country Romania in which it was first found.—On rocks and soil in high altitudes; calciphile.

ILLUSTRATIONS: Schiffner, Beih. Bot. Centralb. 23: figs. 1-24, 1908; Massalongo, Atti Istit. Veneto 75: pl. 7, 1916; K. Mueller (409) 1: figs. 180-181; Haynes, Bryologist 18: figs. 1A-1B, 1915. EXAMINATIONS:—*Alta.* Mt. Bosworth near Stephens (Brinkman 822) 1913.—*B. C.* Mt. Hector (Brinkman 810) 1913; Golden (Taylor 33) 1923.

TYPE LOCALITY: Bucegi Mountains of Romania (Simeon St. Radian) 1899. RANGE: Alta. (199), B. C. (267); Eur. (409).

PREISSIA[106] Corda, Opiz, Beitr. 647, 1829.

Cyathophora of S. F. Gray, Nat. Arr. Brit. Pl. 1:683, 1821; not of Beauv. Fl. Oware et Benin Afrique, 1805.
Chomiocarpon[107] Corda, Opiz, Beitr. 647, 1829.

Thalli dichotomous, also later with numerous apical innovations, green or somewhat purplish. Ventral scales lunate, appendiculate, in 2 longitudinal rows. Dorsal epidermis 1 cell thick, with few chloroplasts, without oil cells or slime cells, without papillae; cells thin walled, without trigones. Air chambers in a single layer, not subdivided by supplementary partitions, with green filaments from the floor; green filaments crowded, simple or branched, of rounded cells; walls nearly always 1 cell thick.[108] Pores barrel-shaped. Ventral tissue of parenchyma with scattered sclerenchymatous cells. Thalli unisexual or bisexual. Antheridial receptacles stalked; stalks with 2-4 rhizoid furrows, without green tissue; disk convex above, with barrel-shaped pores, with membranous margin, scarcely or not at all lobed; antheridia in 3-6 radiating series in acropetal succession. Female receptacles stalked; stalks with 2-4 rhizoid furrows, without green tissue; disk with barrel-shaped pores, shallowly about 4-lobed; rays represented by 4 ridges on the upper side, alternating with the lobes; archegonia in a group beneath each ray, each group enclosed by an involucre. Involucre undivided, membranous, its margin subentire; pseudoperianth enclosing a single sporophyte, membranous, campanulate, abruptly contracted at first to a narrow tubular mouth. Sporangium subspheric; wall 1 cell thick except in a small apical area; wall cells with annular thickenings, dehiscence by irregular clefts from tip, the thickened apical portion not remaining intact. Elaters long, slender, with 2-3 spirals. Spores tetrahedral, with narrow wing-marginal folds; surface lamellose. Named in honor of Prof. Balthasar Preiss, a regimental physician in Praha, Czechoslovakia.

[106] prīs' sĭ ă.

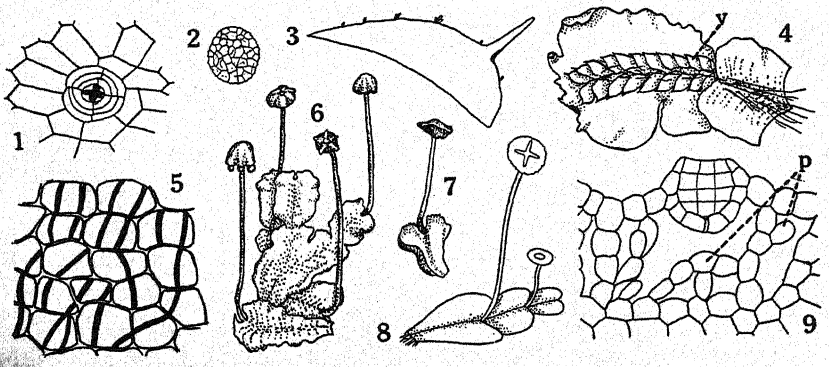
[107] Kaalaas (329) and Lindberg & Arnell (350) spell this *Chomocarpon*, considering the "i" incorrect. We are following the original spelling in the absence of proof of a typographical error.

[108] Macvicar figures them thicker in his Student's Handbook Brit. Hep., Ed. 2, 44, fig. 4, 1926.

Preissia quadrata[109] (Scop.) Nees Naturg. Eur. Leberm. 4:135, 1838.

Marchantia hemisphaerica of L. Fl. Suecica, Ed. 2, 405, 1775; not L. Sp. Pl. 1138, 1753.
Marchantia quadrata Scop. Fl. Carnolica, Ed. 2, 355, 1772.
Marchantia triandra of Weber Spic. Fl. Goettingen 163, 1778; not of Scop. Fl. Carnolica, Ed. 2, 355, 1772.
Marchantia androgyna of Weber Spic. Fl. Goettingen 168, 1778; not of L. Sp. Pl. 1138, 1753.
Marchantia trilobata Schrank Baier. Fl. 2:502, 1789.
Reboulia quadrata Bertol., Amoen. Ital. 440, 1819.
Cyathophora angustifolia S. F. Gray Nat. Arr. Brit. Pl. 1:683, 1821.
Conocephalum hemisphaericum Dum. Comm. Bot. 115, 1822.
P. italica Corda, Opiz, Beitr. 647, 1829.
Marchantia commutata Lindenb., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 14: Suppl. 101, 1829.
Conocephalus quadratus Hueben. Hep. Germ. 11, 1838.
P. commutata Nees Naturg. Eur. Leberm. 4:117, 1838.
P. hemispherica Cogn., Bull. Soc. Bot. Belgique 10:296, 1872.
Cyathophora commutata Trev., Mem. Istit. Lomb. 13:438, 1877.
Cyathophora quadrata Trev., Mem. Istit. Lomb. 13:438, 1877.
Chomiocarpon quadratus Lindb. Hep. Utveckl. 6, 1877.
Chomiocarpon quadratus var. *commutatus* Lindb., Acta Soc. Fauna et Fl. Fennica 2 (3):4, 1882.
P. mexicana Steph., Hedwigia 4:1, 1883.
Cyathophora hemisphaerica Kuntze, Revue Gen. Bot. 834, 1891.
Chomiocarpon commutatus Lindb., C. Jensen in Revue Bryol. 20:66, 1893.

Thalli mostly 2-3 cm long and 0.5-1 cm wide, usually pale green, with margins and ventral side purplish, sometimes purplish throughout. Ventral scales appendiculate; appendages lanceolate to narrowly ovate-lanceolate, mostly 350-450 μ long and 150-300 μ wide, acuminate, subentire to coarsely and sparingly dentate. Dorsal epidermal cells averaging about 28 x 38 μ. Pores usually bounded by 4-5 vertically superimposed



Preissia quadrata. 1, Pore of thallus, dorsal view, x 90. 2, Spore, x 125. 3, Ventral scale, x 12.5. 4, Portion of thallus, ventral view, (*v*) ventral scale, x 3.5. 5, Thickenings in wall of sporangium, x 170. 6, Plant with female receptacles, x 0.75. 7, Plant with antheridial receptacle, x 0.75. 8, Plant with both male and female receptacles, x 0.75. 9, Part of vertical section of thallus through pore, (*p*) photosynthetic filaments, x 160. (2, 3, after Casares-Gil; 8, after Massalongo; the others after K. Mueller.)

[109] Read 13 iii.

circles of 4-5 cells each, the opening through the inner cells +-shaped. Ventral tissue with sclerenchymatous cells wanting to usually conspicuous, often with a rather wide and distinct longitudinal strand of mycorrhiza on each side of the vein among dark or reddish cells. Thalli unisexual or bisexual. Antheridial receptacles stalked; stalk 1-2 cm long; disk mostly 2-3 mm wide, often purplish. Female receptacles stalked; stalk 5-10 cm long; disk about 5 mm wide, often purplish. Elaters about 8 μ wide. Spores mostly 55-70 μ, tetrahedral, brown; wing-marginal folds narrow; surface with low lamellae. L. *quadrata,* squared; in reference to the top view of the female receptacle.—On banks and rocks; calciphile.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 6, 1916; Pearson (433) pl. 211; K. Mueller (409) 1: figs. 182-184; Gil (76) figs. 161-162; Macvicar (374) 44, figs. 1-4; Scopoli, Fl. Carnolica, Ed. 2, pl. 63, 1772; Schiffner (458) figs. 6A, 11C-E, 20; Warnstorf (523) 95, fig. 8. EXAMINATIONS:—*N. Y.* Kirkville (Underwood & Cook) 1894.—*Mich.* Cheboygan County (Wollett) 1923.—*S. Dak.* Lead (Frye) 1935.—*Colo.* S. Cheyenne Canyon (Sheldon) 1903.—*Wyo.* Big Piney Creek in Sheridan County (Porter 283) 1931.—*Mont.* Glacier Nat. Park (Frye) 1934.—*Alaska,* Aats Bay (Frye) 1913.—*Wash.* Queets River Valley (Frye) 1907.—*Ore.* Wallowa River (Rakestraw) 1935.

TYPE LOCALITY: European. RANGE: Greenland (320), Hudsons Bay (504), Newfoundland (513), Cape Breton Isl. (373), N. S. (413), N. B. (513), Me. (203), N. H. (359), Vt. (140), Mass. (5), R. I. (159), Conn. (212), N. Y. (57), Que. (178), Pa. (125), Ont. (373), Mich. (222), Wis. (91), Minn. (513), Iowa (88), S. Dak., Wyo. (412), Mont. (81), Alta. (373), Yukon (51), Alaska (212), B. C. (508), Wash. (81), Ore. (239), Ida. (508), Colo. (175), Neb. (204), Ky. (218), Va. (127), N. J. (506); Mex. (212); Asia (409); Eur. (458); King Oscar Land (325).

There is only one species. Lindberg recognizes *P. quadrata* var. *commutata* on the basis of narrower plants with less quadrate female receptacles and more involucres. Macvicar (374, page 45) finds no difference in involucres.

MARCHANTIA[110] L. Sp. Pl. 1137, 1753.

Chlamidium Corda, Opiz, Beitr. 647, 1829.

Thalli perennial, flat, dichotomously branched, without ventral branches, green or more or less purplish. Gemmae discoid, with 2 opposite apical cells, attached vertically by short stalks, in cupules; cupules on the dorsal surface cup-shaped, with dentate or laciniate margins. Upper surface distinctly showing polygonal areas coinciding with the air chambers beneath, sometimes papillose. Ventral scales in 4 or more longitudinal rows, membranous, with slime papillae, the median ones lunate and appendiculate, the others narrower and not appendiculate. Dorsal epidermis 1 cell thick or locally 2, usually but not always without chloroplasts, without trigones, sometimes with oil cells or slime cells. Air chambers in a single layer, not subdivided by supplementary partitions, with green filaments from the floor; green filaments crowded, simple or branched; their cells rounded, narrowed at base, the terminal cells like

[110] mär shän' shĭ ä.

the others in color and form; walls 1 cell thick. Pores barrel-shaped, bounded by usually 4-7 superimposed circles of cells. Ventral tissue of parenchyma with more or less pitted walls, sometimes with scattered sclerenchymatous cells, sometimes with slime cells. Thalli unisexual. Antheridial receptacles terminal, stalked; stalk with 2-4 rhizoid furrows, usually with 1-2 longitudinal bands of green tissue; disk flattish above, with barrel-shaped pores, more or less distinctly lobed; lobes mostly 4-8; antheridia in upper surface, in acropetal series on each lobe. Female receptacles terminal, stalked; stalk with 2-4 rhizoid furrows, with 1-2 longitudinal bands of green tissue; disk convex above, with barrel-shaped pores, distinctly lobed; lobes mostly 5-9; archegonia soon ventral, in acropetral groups alternating with the rays, each group enclosed by an involucre. Involucre bipartite, membranous, its margin often toothed or laciniate; pseudoperianth enclosing a single sporophyte, membranous campanulate, at first abruptly contracted to a tubular mouth. Sporophyte composed of sporangium with seta and foot. Seta short. Sporangium subspheric; wall of 1 layer of cells except in a small apical area; wall cells with annular thickenings; dehiscence by means of irregular splits beginning near the apex, the thickened apical portion remaining intact. Elaters long, slender, with 2 spirals. Spores either tetrahedral with narrow wing-marginal border and surface lamellae, or spherical and smooth. Named in honor of Nicolas Marchant, director of the botanical Garden of Gaston d'Orleans in Blois, France.

Thallus without sclerenchymatous cells; gemmae cups with surface papillae; ventral scales in 6 or more rows; rays of the female receptacle terete, with numerous surface papillae. Inner opening of the pores sometimes cruciate and sometimes not..... 1. *M. polymorpha.*

Thallus with sclerenchymatous cells; gemmae cups without surface papillae; ventral scales in 2 or 4 rows; rays of the female receptacle flattish, without surface papillae.

Inner opening of the pores cruciate; appendages of the median ventral scales vaguely dentate; stalk of the antheridial receptacle without band of green tissue..... 2. *M. paleacea.*

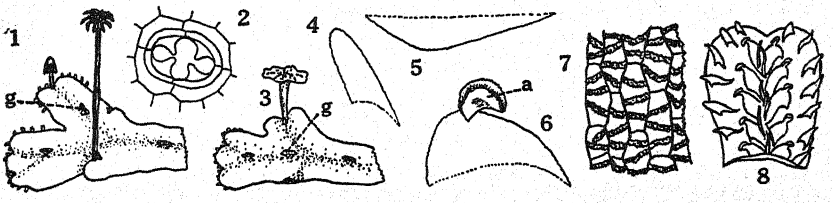
Inner opening of the pores not cruciate, its sides nearly straight; appendages of the median ventral scales closely dentate, the teeth 1-2 cells long; stalk of the antheridial receptacle with 1 wide band of green tissue..... 3. *M. domingensis.*

1. Marchantia polymorpha[111] L. Sp. Pl. 1137, 1753.

M. stellata Scop. Fl. Carnolica, Ed. 2, 353, 1772.
M. umbellata Scop. Fl. Carnolica, Ed. 2, 354, 1772.
M. polymorpha var. *domestica* Wahl. Fl. Lapp. 397, 1812.
M. latifolia S. F. Gray Nat. Arr. Brit. Pl. 1: 682, 1821.
M. minor S. F. Gray Nat. Arr. Brit. Pl. 1:682, 1821.
M. coarctata Corda, Opiz, Beitr. 647, 1828, the name only.
M. elliptica Corda, Opiz, Beitr. 647, 1828, the name only.
M. kablichiana, Corda, Opiz, Beitr. 647, 1828, the name only.

M. kablikiana Corda, Opiz, Beitr. 647, 1828.
M. microcephala Corda, Sturm Deutsch. Fl. Jung. 63, 1832.
M. vittata Raddi, Mem. Soc. Ital. Sci. Modena 20:45, 1829.
M. polymorpha f. *alpestris* Nees Naturg. Eur. Leberm. 4:70, 1838.
M. polymorpha f. *aquatica* Nees Naturg. Eur. Leberm. 4:65, 1838.
M. polymorpha f. *communis* Nees Naturg. Eur. Leberm. 4:65, 1838.
M. syckorae Corda, Nees Naturg. Eur. Leberm. 4:97, 1838.
M. oregonensis Steph., Roell in Bot. Centrab. 45:203, 1891.
M. polymorpha f. *mamillata* Hag., Schiffn. in Lotos 49:93, 1901.

Thalli mostly 4-6 cm long and about 1 cm wide, delicate to firm but never leathery, pale green to dark green, sometimes with a brownish median band, often purplish beneath. Gemmae cups deeply lobed, outer surface with papillae; lobes acute to acuminate, dentate to shortly spinose. Upper surface sometimes papillose near the pores. Ventral scales in 6



Marchantia polymorpha. 1, Plant with female receptacle, (*g*) gemmae cup, x 0.7. 2, Pore, interior view, x 100. 3, Plant with antheridial receptacle, (*g*) gemmae cup, x 0.7. 4, Ventral scale of marginal row, x 27. 5, Ventral scale of costal row, x 27. 6, Ventral scale of intermediate row, (*a*) appendage, x 27. 7, Thickenings in wall of sporangium, x 100. 8, Portion of thallus, ventral view, x 13. (1, 3, after Casares-Gil; the others after Massalongo.)

more or less distinct longitudinal rows, the marginal ones usually projecting; the costal ones lanceolate; the intermediate ones appendiculate; appendages broadly orbicular, mostly 500-750 μ long and 600-800 μ wide, rounded to very bluntly pointed, the margin minutely and irregularly denticulate or crenulate. Dorsal epidermal cells averaging about 16 x 19 μ. Pores usually bounded by 4 superimposed circles of 4 cells each, in surface view surrounded by 4 radial rows of 2 cells each; cells of the lower bounding circle each with one projection into the pore, the 4 projections rough, rounded or flattish, sometimes almost closing the opening. Ventral tissue without sclerenchymatous cells or slime cells. Thalli unisexual. Antheridial receptacles stalked; stalk 1-3 cm long, with 2 rhizoid furrows, without green tissue; disk mostly 7-10 mm wide, crenate to shortly lobed; lobes mostly 8, somewhat symmetrically spaced. Female receptacles stalked; stalk 2-7 cm long, with 2 rhizoid furrows, with 1 band of green tissue; disk mostly 8-13 mm wide, with long lobes; lobes usually 9, 3-5 mm long, terete, with numerous surface papillae, separated by somewhat equal sinuses. Involucre deeply and irregularly lobed; the lobes long-acuminate, their margins ciliate. Elaters 3-5 μ wide. Spores 12-15 μ, yel-

low, nearly smooth. Gk. *polys,* many and *morphe,* form; referring to the great variability of the thallus in different habitats.—On damp soil in moist air or even where at times submerged; common in damp regions, in gardens, green houses and on burned-over areas.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 4, 1916; Pearson (433) pl. 208; K. Mueller (409) 1: figs. 185-187; Gil (76) figs. 142B, b, b', 145, 164-165; Schiffner (458) figs. 9-10, 21A-C; Macvicar (374) 46, figs. 1-6. EXAMINATIONS:—*Conn.* S. Glastonebury (Wilson) 1889.—*N. J.* Highlands (Haynes) 1902.—*Pa.* Sayre (Barbour) 1901.—*N. Y.* Herkimer County (Haynes) 1903.—*Mo.* Hannibal (Davis) 1911.—*S. Dak.* Spearfish (Frye) 1935.—*N. Dak.* Kirk (H. L. Bolley) 1892.—*Utah.* Marysville (M. E. Jones 5342) 1894.—*Wyo.* Centennial (Frye) 1931.—*Mont.* Lolo Hot Springs (Frye) 1929.—*Ida.* Moscow (Clark) 1926.—*Alaska.* Tongas Village (Walker) 1915; Akutan Island (J. Rudd) 1935.—*B. C.* Grand Forks (Frye) 1928.—*Wash.* Lakota (Clark) 1924.—*Ore.* Mt. Hood (Frye) 1933.—*Cal.* Mt. Lassen (Frye) 1933.

TYPE LOCALITY: European. RANGE: Greenland (248), Labrador (510), Newfoundland (513), Cape Breton Isl. (413), N. S. (373), N. B. (373), Me. (443), N. H. (359), Vt. (169), Mass. (232), R. I. (140), Conn. (193), N. Y. (258), Que. (178), Pa. (237), Ont. (373), Mich. (415), Ind. (247), Ill. (454), Wis. (94), Iowa (88), Minn. (513), Man. (373), Sask. (390), Alta. (51), Yukon (51), Alaska (100), B. C. (372), Mont. (81), Wash. (81), Ore. (457), Ida. (81), Wyo. (81), Colo. (448), Utah, Cal. (335), Ariz. (184), N. Mex. (481), Okla. (463), Neb. (204), Mo., Ky. (218), Tenn. (464), Fla. (266), N. C. (43), Va. (127), W. Va. (466), Md. (444), N. J.; Bermuda (146); West Indies (199); Mex. (182); Central Amer. (199); S. Amer. (132); Hawaii (173); N. Z. (207); Java (32); Asia (409); Eur. (182); King Oscar Land (325); Azores (32); Crozet Isl. (207); Kerguelen Isl. (207).

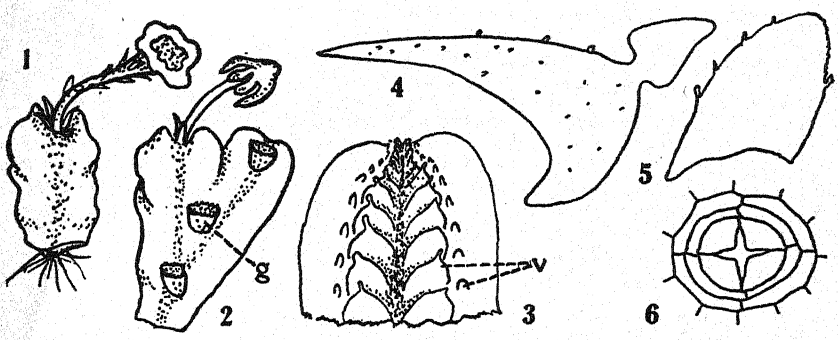
2. Marchantia paleacea[112] Bertoloni, Opusc. Sci. Bologna 1:242, 1817.

M. papillata var. *italica* Raddi, Mem. Soc. Ital. Sci. Modena 19:44, 1823.
Fimbriaria paleacea Corda, Opiz, Beitr. 648, 1829.
M. nepalensis Lehm. & Lindenb., Lehm. Stirp. Pugil. 4:10, 1832.
M. nitida Lehm. & Lindenb., Lehm. Stirp. Pugil. 4:11, 1832.
M. squamosa Raddi, Lehm. Stirp. Pugil. 4:12, 1832, in part.
M. tholophora Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 17:989, 1835.
M. calcarata Steph., Bull. Herb. Boissier 5:98, 1897.
M. planipora Steph., Bull. Herb. Boissier 5:98, 1897.

Thalli mostly 2-4 cm long and 5-8 mm wide, firm but scarcely leathery, pale green, often glaucous, sometimes purplish beneath. Gemmae cups deeply lobed; the lobes acute to acuminate, dentate to shortly spinose, without papillae. Upper surface lacking papillae. Ventral scales in 2 or 4 longitudinal rows; the two small rows easily overlooked and by some writers not considered;[118] the larger ones appendiculate; appendages oblong to ovate-orbicular, mostly 600-750 μ long and 450-600 μ wide, rounded to acute at apex, entire to vaguely dentate. Dorsal epidermal cells averaging about 30 x 43 μ. Pores bounded by 6 superimposed circles of 4 cells each, those of the lower circle bounding a cruciate opening. Ventral tissue with sclerenchymatous cells and sometimes with slime cells. Archegonial receptacles stalked; stalk 5-7 mm long, with 2 rhizoid fur-

M. [illegible] a'se a.
[illegible] (76) fig. 163 b, shows them: Massalongo, Atti Istit. Veneto 75: pl. 5, figs. 4, 9, shows [illegible] (409) 1:307, says there is only one kind.

rows, without green tissue, scaly along upper part; these scales narrowly lanceolate, reddish brown; disk mostly 5-6 mm wide, shortly lobed; lobes usually 8, somewhat symmetrically spaced. Female receptacles stalked;



Marchantia paleacea. 1, Plant with antheridial receptacle, x 1. 2, Plant with female receptacle, (*g*) gemmae cups, x 1. 3, Part of thallus, ventral view, (*v*) ventral scales, x 5. 4, Ventral scale from inner row, x 17. 5, Ventral scale from outer row, x 25. 6, Pore of thallus, interior view, x 150. (3-5, after Casares-Gil; the others after Massalongo.)

stalk 2-4 cm long, with 2 rhizoid furrows, with 1 wide band of green tissue, scaly along upper part; these scales narrowly lanceolate, reddish brown; disk mostly 5 mm wide, deeply lobed; the lobes mostly 9, separated by somewhat equal sinuses or one sinus wider than the others, dilated at the truncate or emarginate apex, flat, without surface papillae. Involucre deeply and irregularly lobed; its lobes long acuminate, with ciliate margin. Elaters 6-8 μ wide. Spores about 34 μ, tetrahedral; wing margin narrow; surface with low lamellae. L. *palea,* chaff; the scaly upper portion of the stalk of the receptacles is paleaceous.—On banks and rocks.

ILLUSTRATIONS: Massalongo, Atti Istit. Veneto 75: pl. 5, 1916; Evans, Trans. Connecticut Acad. Arts Sci. 21: figs. 6-8, 1917; K. Mueller (409) 1: figs. 188-189; Gil (76) fig. 163. EXAMINATIONS:—*Tex.* Kyle (MacAllister) 1922.

TYPE LOCALITY: Italy. RANGE: Okla. (354), Tex. (201), Ariz. (184); West Indies (199); Mex. (182); Guatemala (199); Asia (491); Eur. (409); Azores (182); Africa (199).

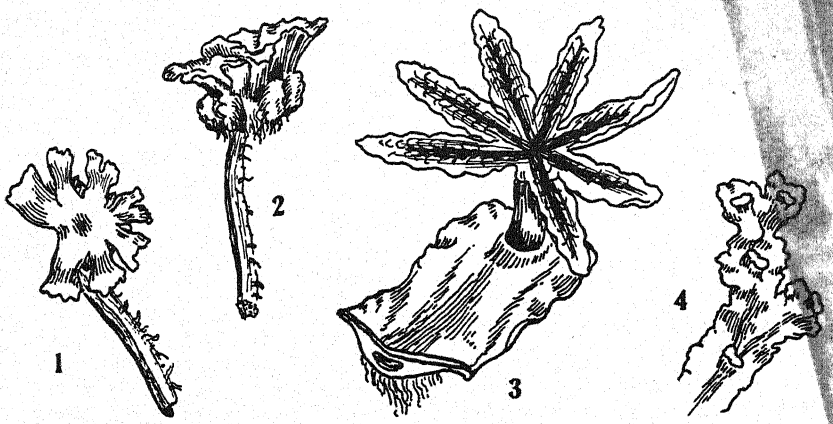
3. **Marchantia domingensis**[114] Lehm. & Lindenb., Lehm. Stirp. Pugil. 6:22, 1834.

M. inflexa Nees & Mont., Mont. in Ann. Sci. Nat., Ser. 2, 9:43, 1838.
M. quinqueloba Nees Naturg. Eur. Leberm. 4:98, 1838.
M. disjuncta Sull., Amer. Jour. Sci. II, 1:74, 1846.
M. linearis G. L. & N. Syn. Hep. 529, 1847, in part; not of Lehm. & Lindenb., Lehm. Stirp. Pugil. 4:8, 1832.
M. martinicensis Spreng., G. L. & N. Syn. Hep. 531, 1847, as synonym.
M. elliottii Steph., Bull. Herb. Boissier 7:400, 1899.
M. caracensis Steph., Bull. Herb. Boissier 7:526, 1899.

Thalli mostly 2-3 cm long and 4-6 mm wide, delicate in texture, pale

[114] dō min ĝĕn′ sis.

green to dark green, not glaucous, sometimes slightly purplish. Gemmae cups closely short-ciliate, without papillae. Upper surface lacking papillae. Ventral scales in 4 longitudinal rows, the inner ones appendiculate;



Marchantia domingensis. 1, 2, Female receptacles, x 2. 3, Portion of thallus with antheridial receptacle, x 3. 4, Thallus with cupules, x 1. (All after Sullivant.)

appendages broadly lanceolate to ovate, mostly 350-600 μ long and 250-450 μ wide but sometimes much smaller, acute or cuspidate to apiculate, closely denticulate or dentate, the teeth 1-2 cells long. Dorsal epidermis in 1 layer or sometimes locally in 2 layers; cells averaging about 23-45 μ, with slightly thickened walls. Pores usually bounded by 6 superimposed circles of 4 or more cells each; cells of the innermost circle usually 4, bounding a broad opening with sides straight or nearly so. Ventral tissue with numerous sclerenchymatous cells, without slime cells. Antheridial receptacles stalked; stalk about 5 mm long, with 2-4 rhizoid furrows, with 1 wide band of green tissue; disk mostly 6-8 mm wide, deeply lobed; lobes mostly 4-6, palmately spreading. Female receptacles stalked; stalk 1.5-2 cm long, with 2-4 rhizoid furrows, with 1 wide band of green tissue; disk mostly 5-7 mm wide, deeply lobed, without surface papillae, with one sinus wider than the others; the lobes 5-11 but usually 7, not or slightly dilated at tip; apex truncate to slightly emarginate. Involucre very delicate, crenulate to shortly ciliate. Elaters about 6 μ wide. Spores about 28 μ, brownish yellow; surface with few lamellae. It was first found in Santo Domingo, in the West Indies, hence the specific name.—On banks.

ILLUSTRATIONS: Sullivant, Mem. Amer. Acad. Arts Sci. Ser. 2, 3: article 2, pl. 3, 1848; Evans, Trans. Connecticut Acad. Arts Sci. 21; figs. 10-12, 1917; Kurz & Little, Bull. Fla. State College for Women 26 (3):26, fig. 5, 1933. EXAMINATIONS: None.

TYPE LOCALITY: Santo Domingo (about lat. 18° 30′ N., long. 70° W.). RANGE: Tenn. (464), Ark. (157), Okla. (354), Tex. (354), Ala. (498), Fla. (337), Ga. (182); West Indies (342); Mex. (225); Central Amer. (182); S. Amer. (182).

JUNGERMANNIALES[115]

Gametophyte thalloid or leafy, simple or branched, without differentiation of a distinct layer of tissue for photosynthesis, without pores or chambers, with or without a vein; chloroplasts several in a cell. Rhizoids smooth, without peg-like thickenings. Sex organs in thalloid species dorsal or approaching terminal, never on specialized stalked receptacles, in leafy species terminal or axillary. Sporophyte a sporangium with seta and foot. Sporangium wall 1 or more cells thick; interior cells in part forming spores and in part remaining sterile; columella none. Dehiscence in most species by 4 valves.

Plants thalloid (except *Fossombronia*, in which the sporangium dehisces irregularly or by imperfect valves).
  Plants submerged, with a long erect stem and one (ours) longitudinal wing-like expansion on the vein, or sometimes 2 (not in ours), not distinctly dorsiventral; elaters none; sporangium wall only 1 cell thick..... *Riellaceae*, p. 114
  Plants terrestrial, prostrate or nearly so, with no wing-like expansion on the vein other than the 2 distinctly dorsiventral halves of the thallus.
    Plants less than 1 cm long, thin, often veinless; elaters none; sporangium wall only 1 cell thick..... *Sphaerocarpaceae*, p. 105
    Plants usually more than 1 cm long, mostly rather thick and firm, commonly with a vein; elaters present; sporangium wall nearly always more than 1 cell thick..... *Metzgeriaceae*, p. 116
Plants with 2 or 3 rows of leaves; dehiscence by valves..... *Jungermanniaceae*, p. ...

Relationships among North American Metzgeriaceae and Related Groups

The diagram on page 104 shows the concept of the relationships between our North American Sphaerocarpaceae, Riellaceae and Metzgeriaceae. The characteristics which mark advances in the Metzgeriaceae are not very clear because they do not advance together. Comments under the letters below are pertinent to the corresponding letters on the figure.

(A) Development of a large wing-like dorsal expansion; a strong vein resulting in a stem; and a wedge-shaped apical cell.

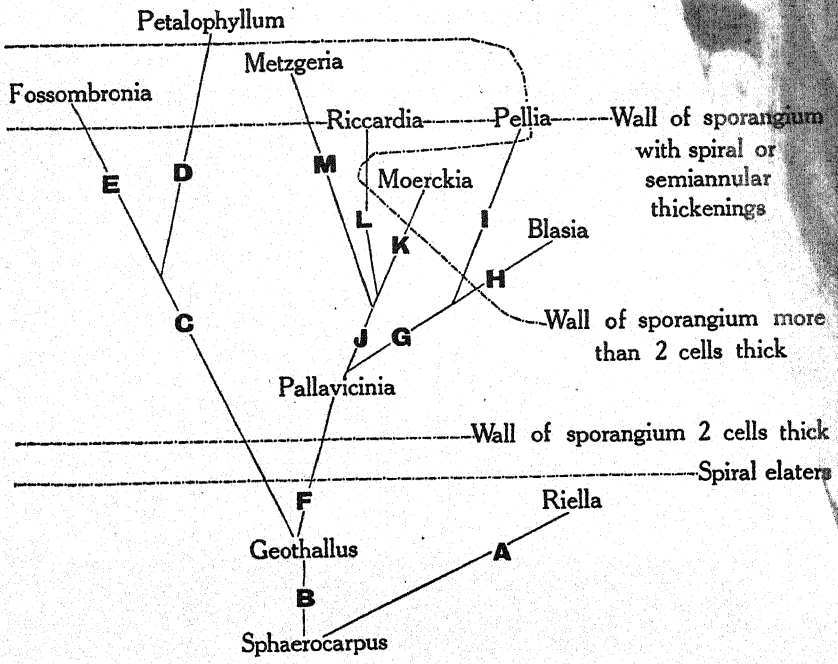
(B) Formation of a thick vein; leaf-like lobes become succubous. Sterile spore mother-cells become somewhat elongated.

(C) Definite apical cell. Dehiscence, but the sporangium breaks open irregularly.

(D) Peculiar lamellae dorsally on the lobes; apical cell cuts cells from 3 sides. Wall of the sporangium 3-4 cells thick.

(E) Definite leaves, succubous.

[115] yūng″ ĕr măn nĭ ā′ lēs.



Philogenetic diagram of North American Metzgeriaceae and related groups.

(F) Archegonia in groups; antheridia in 2 rows; involucre of scales. Dehiscence by valves.

(G) Elater bearers at base.

(H) Gemmae of 2 kinds, one in flask-shaped dorsal container; thallus rather regularly lobed. Sporangium wall 3-4 cells thick; elater bearers few.

(I) Wall of sporangium 2-3 cells thick, inner wall with or without spiral or semiannular thickenings; elater bearers basal.

(J) Elater bearers at tip.

(K) Wall of sporangium 3-6 cells thick.

(L) Thallus thicker. Inner and outer walls of the sporangium with or without spiral or semiannular thickenings.

(M) Thallus thinner. No spiral or semiannular thickenings in outer wall of sporangium, inner wall always with them.

SPHAEROCARPACEAE[116]

Plant terrestrial, consisting of an irregular to elongate thallus notched at margin, without air chambers or pores, more than 1 cell thick in the central regions, from veinless to almost developing a stem with leaf-like lobes. Rhizoids from the base and basal part of under side, with smooth walls. Thalli unisexual. Antheridia spherical, scattered or aggregated, on the dorsal surface, each enclosed in a flask-shaped involucre. Archegonia scattered or aggregated on the dorsal surface, each enclosed in a tubular or subglobose involucre. Seta short. Sporangium opening by decomposition or irregularly, without elaters but with sterile cells among the spores; its wall 1 cell thick, without spiral thickenings in the cells. Spores remaining in tetrads in maturity or separating.

Female plant suborbicular, its lobes almost entirely concealed by the involucres; annual..... *Sphaerocarpus*, p. 105
Female plant with thick elongate axis and conspicuous lateral leaf-like succubous lobes, perennial by a tuber..... *Geothallus*, p. 112

SPHAEROCARPUS[117] (Micheli) Boehm., Ludwig Def. Gen. Pl., Ed. 2, 501, 1760.

Sphaerocarpos Micheli Nov. Pl. Gen. 4, pl. 3, 1729.
Symphoricarpus Adans. Fam. Pl. 2:14, 1763.

Plant thalloid, small, orbicular to oblong or cuneate, simple or dichotomous, unistratose at margin, gradually grading into the several-stratose median region. Vein not distinguishable. Margin somewhat lobed, the lobes unistratose. Ventral scales none. Dorsal epidermis thin walled, quadrate to long-pentagonal or hexagonal; trigones none. Thalli unisexual; antheridial plants smaller, commonly purplish. Antheridia and archegonia dorsal, thickly aggregated along the central region or widely distributed over the surface, each enclosed in an involucre. Antheridia oval or spherical, shortly stalked, their involucres flask-shaped. Archegonia in tubular to pyriform or subglobose involucres. Calyptra early ruptured, the upper part long persistent on the sporangium. Sporophyte of sporangium with seta and foot. Seta very short or obsolescent; foot bulbous. Sporangium opening by decomposition or irregular breakage; wall of 1 layer of cells, without local thickenings of any kind; sterile cells spherical, without thickenings in their walls, containing much starch, smaller than the mature spores. Spores permanently in tetrads or falling apart in maturity; distinctly areolate or tuberculate to cristate-reticulate.

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[116]sphē" rō kär pā' sē ē.
[117]sphē rō kär' pŭs. The name, spelled Sphaerocarpus, was also used for a genus of the family Cruciferae in the 1st edition of Fabricius Enumeratio Pl. Hort. Helmstadiensis, in [illegible] (296). The Greek ending "os" is clearly the original form, although the Latin "us" [illegible] commonly used, and will be used from now on throughout the plant kingdom orthography one.

Spores permanently united in tetrads.
- Female involucre so widely mouthed that the upper part is subcylindrical; spore surface cristate; reticulate..... 1. *S. hians.*
- Female involucre contracted at mouth.
  - Spore surface mostly of thick somewhat roughly parallel lines with occasional reticulations on outer face..... 2. *S. drewei.*
  - Spore surface regularly reticulate on outer surface..... 3. *S. texanus.*

Spores not permanently united in tetrads.
- Spores separating at maturity, 85-138 μ, areolate, with a tubercle about 12 μ high on the middle of the outer face, basal margin coarsely lobed..... 4. *S. donnellii.*
- Spores separating long before maturity, 52-80 μ, sometimes areolate but usually cristate, without prominent tubercle on outer face, basal margin not or hardly lobed..... 5. *S. cristatus.*

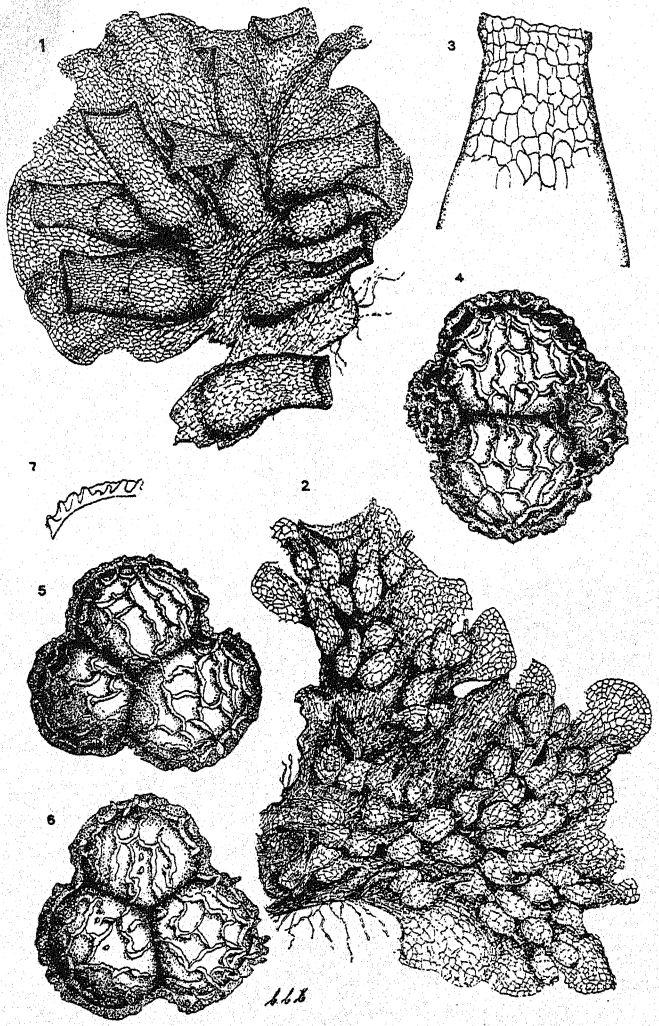
1. Sphaerocarpus hians[118] Haynes, Bull. Torr. Bot Club 37:225 1910.

Female thalli growing in isolated groups, 4-6 mm in diameter, oblong or orbicular, bright green when dry. Margin lobed, crispate, ascending; marginal cells usually quadrate, averaging 47 μ. Archegonial involucres 1-2 mm high, sessile, not crowded, not entirely concealing the thallus, tubular-ovoid, sometimes larger at apex and slightly flaring; mouth large, from nearly as wide to wider than the upper part of the involucre, irregular, entire; cells near mouth thick walled, 26 x 39 μ. Antheridial thalli growing in groups, 2 mm in diameter, cuneate to orbicular, forking several times, commonly purplish. Margin lobed; lobes leaf-like, curved over the involucres. Antheridial involucres 240-400 μ high, green, brownish or purplish with age; cells near mouth thin walled, not protuberant. Seta and foot remaining attached to sporangium. Sporangia averaging 585 μ thick. Spores permanently united in tetrads; tetrads 66-85 μ, golden brown, cristate-reticulate; crests sinuous, 5 μ high, delicate, somewhat elevated at the angles, occasionally crossing the boundaries of the spores, anastomosing irregularly, forming closed or partially closed meshes or occasionally toward the boundaries of the spores running in parallel lines; meshes occasionally containing a spine or two; margin of spore in optical section apparently crenulate to tuberculate. L. *hians,* open, gaping; referring to the female involucre.—On damp clayey or alluvial soil.

ILLUSTRATIONS: Haynes, Bull. Torr. Bot. Club 37: pl. 28, 1910. Clark & Frye (81) 29, figs. 1-7. EXAMINATIONS:—*Ida.* Paradise Creek near Moscow (Clark) 1924.

TYPE LOCALITY: Pullman, Washington. RANGE: Ida. (81), Wash. (81).

[118] Miss Haynes uses the ending "os," considering the ending "us" as a mere variant.



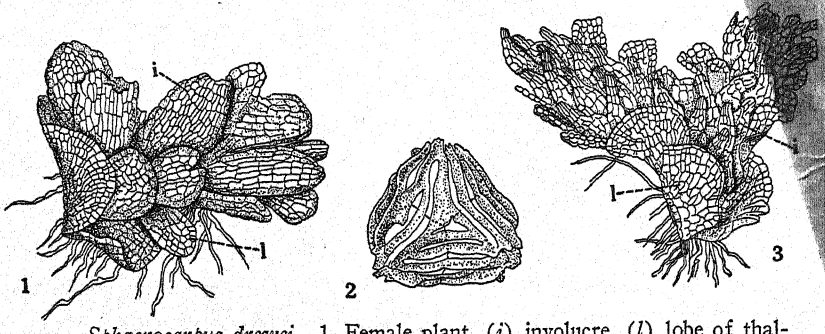
Sphaerocarpus hians. 1, Plant with female involucres, x 11. 2, Plant with antheridial involucres, x 24. 3, Mouth of female involucre, x 38. 4-6, Tetrads of spores, x 308. 7, Ridges of spores in optical section, x 308. (All after Haynes.)

2. **Sphaerocarpus drewei**[119] Wigglesworth, Univ. Calif. Pubs. Bot. 16:129, figs. 1-10, 1929.

Plants unbranched or bifurcate, lobed, with several growing points, elongating obliquely, 4-5 cells thick in the central region, thinner toward margin where the leaf-like lobes occur. Rhizoids numerous, on the under

[119] drū' ē ī.

side. Leaf-like lobes 1 cell thick, obliquely inserted, succubous, suberect and decurrent for the greater part of their length. Specially on male plants branches sometimes are present with a more or less distinct axis which bears succubous lobes. Plants unisexual. Male plants about the same size as the female, reddish purple, usually twice forked, averaging 1.4 mm long; vein or axis 199-332 μ wide, of cells 68 x 24 μ; leaf-like



Sphaerocarpus drewei. 1, Female plant, (*i*) involucre, (*l*) lobe of thallus, x 23. 2, Tetrad of spores, x 180. 3, Male plant; (*i*) involucre; (*l*) lobe of thallus, x 23. (All after Wigglesworth.)

lobes as on the female plant but rather smaller, averaging about 370 μ wide, their marginal cells isodiametric, 39.6 μ; involucres covering the dorsal surface of the axis, flask-shaped, averaging 359 μ long, 66-146 μ wide, the cells of the mouth averaging 55 x 27.6 μ. Female plants suborbicular, sometimes with an elongate upturned branch, pale green, becoming tinged with purplish red at the margins of the leaf lobes and on the exposed parts of the involucres, averaging 1.3 mm long; the vein or axis 385 μ wide, its cells averaging 88 x 39 μ; leaf-like lobes wedge-shaped, averaging 540 μ wide, dorsal margin often suberect, the marginal cells usually quadrate, 22-33 μ; involucres crowded on the dorsal surface of the axis, subcylindrical or obovate, averaging 997 μ long and about 495 μ wide in widest part; mouth bounded by about 12 cells which average 49 x 30 μ, median involucral cells 55-110 x 22-44 μ. Seta very short, 33-44 μ thick, 66 μ long; foot bulbous, remaining imbedded in the tissue of the thallus. Sporangium 340-590 μ in diameter.[120] Sterile spore mother-cells irregular, mostly oval, 44 x 33 μ. Spores remaining in tetrads in maturity; tetrads dark brown, 66-154 μ, lamellate. Lamellae of tetrads becoming thick and granulate, lobed in places, somewhat parallel in 2 directions on the outer surface, not reticulate, somewhat branching. Named in honor of the collector, Miss K. K. Drew.—On bare ground on a hillside.

[120] The original description is 34-59 mm, which is evidently an error. From Wiggleworth's figure 3 the sporangium must be about 350 mu, from which it seems that 340-590 mu was probably intended.

ILLUSTRATIONS: Wigglesworth, Univ. Calif. Pub. Bot. 16:129-137, figs. 1-10, 1929. EXAMINATIONS: None.

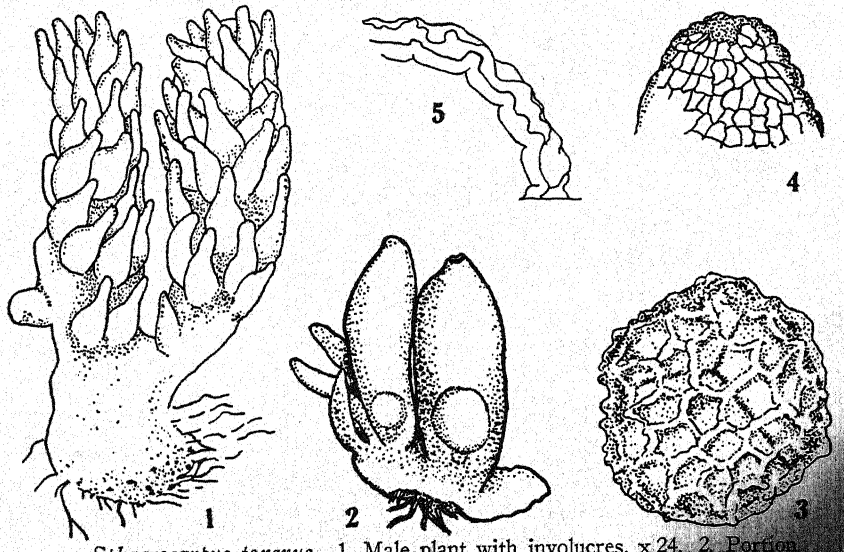
TYPE LOCALITY: On a hillside near Scripps Institution, La Jolla, California (Drew), 1926. RANGE: Known only from the type collection.

Whether *S. drewei* is most nearly related to *S. cristatus* on account of the non-areolate spores, or to *S. texanus*, on account of the permanently united spores, depends upon the significance one attaches to these differences. One wonders whether it could be *Geothallus tuberosus* which had not formed the tubers.

3. **Sphaerocarpus texanus**[121] Aust., Bull. Torr. Bot. Club 6:158, 1877, with the generic ending "us."

Sphaerocarpus terrestris Bisch., Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 13:829, 1827, in part.
Sphaerocarpus californicus Aust., Bull. Torr. Bot. Club 6:305, 1879.
Sphaerocarpus berterii of Aust., Hep. Bor.-Amer. No. 34, 1873; not of Mont., Ann. Sci. Nat., Ser. 2, 9:39, 1838.
Sphaerocarpus michelii var. *californicus* Aust., Underw. in Bull. Ill. State Lab. Nat. Hist. 2:30, 1884.
Sphaerocarpus terrestris var. *californicus* Underw., Zoe 1:364, 1890.

Female thalli caespitose, 3-5 mm wide, 4-8 mm long, suborbicular or somewhat cuneate, dichotomous, bright green when alive, dingy green or sometimes light olive green when dry; lobes leaf-like, unistratose, almost entirely concealed by the involucres; marginal cells usually quadrate, averaging 45 μ. Archegonial involucres 1.2-2.6 mm high, sessile, not entirely concealing the thallus, long cylindric to fusiform-clavate or very rarely



Sphaerocarpus texanus. 1, Male plant with involucres, x 24. 2, Portion of female thallus with involucres of various ages, x 11.5. 3, Tetrad of spores, x 390. 4, Mouth of female involucre, x 48. 5, Ridges of spore in optical section, x 390. (1, 2, after Howe; the others after Haynes.)

[121] tĕx ā' nŭs.

subpyriform, more or less acuminate, with small mouth; cells near mouth usually arcuate-protuberant, 45-60 μ. Antheridial thalli 2 mm wide, orbicular to oblong, forking several times; antheridial involucres 270-360 μ high, purplish. Seta and foot remaining attached to sporangium. Sporangia averaging 675 μ thick. Spores permanently united in tetrads; tetrads 72-170 μ, golden brown to dark opaque brown; outer faces regularly areolate, minutely granulate; meshes 13-30 μ in diameter, in rare cases each with a single median papilla or tubercle; their ridges finally high, sinuate to crenulate or deeply and irregularly dissected, occasionally with obtuse spines at the points of intersection. Name from the state in which the type material was gathered.—On damp soil.

ILLUSTRATIONS: Haynes, Bull. Torr. Bot. Club 37:26-27, 1910; Bischoff, Nova Acta Acad. Caes. Leop.-Carol. Nat. Cur. 13: pl. 44 in part, 1827; Howe, Mem. Torr. Bot. Club 7: pl. 100, figs. 9-12, 1899; Allen, Proc. Amer. Phil. Soc. 58:289-316, figs. 5-8, 1919; K. Mueller (409) 1: fig. 192; Douin, Revue Bryol. 34: figs. 4-10, 12-14, 1907, 36: figs. 4, 7, 10, 1909; Kurz & Little, Bull. Fla. State College Women 26:26, fig. 6, 1933. EXAMINATIONS:—*Fla.* Sanford (Rapp) 1912.—*Wash.* Friday Harbor (Frye) 1929.

TYPE LOCALITY: San Marco, Texas (Dr. C. Wright) 1849. RANGE: Wash. (82), Ore. (457), Cal. (202), Tex. (1), Okla. (354), La. (526), Miss. (526), Ala. (396), Fla. (266), Ga. (52), S. C. (526), N. C. (43), Va. (396); S. Amer. (264); Eur. (134); Africa (264).

This species was not distinguished by early European writers from *S. michelii* (*S. terrestris*) with which it sometimes grows intermingled in Europe. This throws doubt upon some of the drawings and perhaps descriptions of *S. terrestris* by J. E. Smith, Bischoff, Lindenberg, Nees, Stephani and Pearson. Accounts of the occurrence of *S. michelii* Bell. in North America probably refer to *S. texanus*. It would, however not be surprising if *S. michelii* were discovered in North America, and it is desirable that material believed to be *S. texanus* be checked with *S. michelii*. This may be done by the following, adapted from Miss Haynes:

(*a*) Female involucre pyriform to obovoid or subglobose; meshes of the spore tetrads 7-15 μ; ridges separating the meshes low, their intersections with very acute or acicular spines.....*S. michelii.*

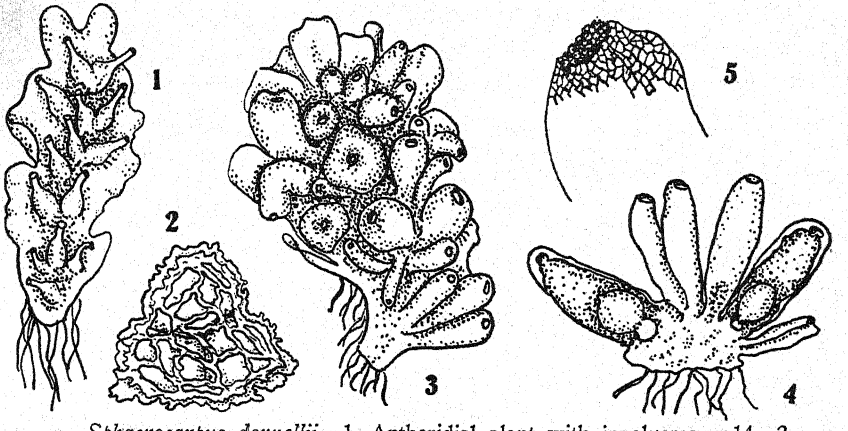
(*aa*) Female involucre subpyriform to fusiform-clavate or tubular; meshes of the spore tetrads 15-30 μ; ridges separating the meshes usually high, sinuous to crenate or dissected, their intersections spineless or with blunt spines.....*S. texanus.*

4. **Sphaerocarpus donnellii**[122] Aust., Bull. Torr. Bot. Club 6:157, 1877.

Female thalli forming mats, averaging 6 mm in greatest width and 9 mm long, cuneate, repeatedly forked, dark green when alive, faded green when dry; lobes large, explanate; margin sinuous; marginal cells usually oblong, 33 x 66 μ. Archegonial involucres 2-2.3 mm high, sessile, not crowded together, somewhat isolated, tubular to ovoid-ellipsoid, truncate at apex; mouth somewhat conspicuous; cells near mouth 39-46 μ. Antheridial thalli up to 3 mm in diameter, cuneate, each of its 5-6 main divisions 1-2 times forked; lobes large, leaf-like. Antheridial involucres 0.5-1

[122] Also see R. L.

mm high, about 3 times as high as wide, reddish brown, the cells with somewhat thick walls. Foot remaining in thallus when sporangium falls off. Sporangia averaging 725 μ thick; tetrads averaging 145 μ just before separating. Spores separating at maturity, 85-138 μ, yellow to opaque brown; outer face with a single median prominence about 12 μ high but



Sphaerocarpus donnellii. 1, Antheridial plant with involucres, x 14. 2, Tetrad of spores, x 156. 3, Female plant with involucres, x 7. 4, Section through plant with involucres showing sporophytes, x 7. 5, Mouth of female involucre, x 24. (5, after Haynes; the others after Allen.)

the projection shrivelling with age, regularly areolate, coarsely granulate, meshes 13-26 μ; their ridges wrinkled, sinuous, with elevations at the intersections; basal margin conspicuously and coarsely lobed. Named in honor of J. Donnell Smith, who first collected it.—On damp sandy soil.

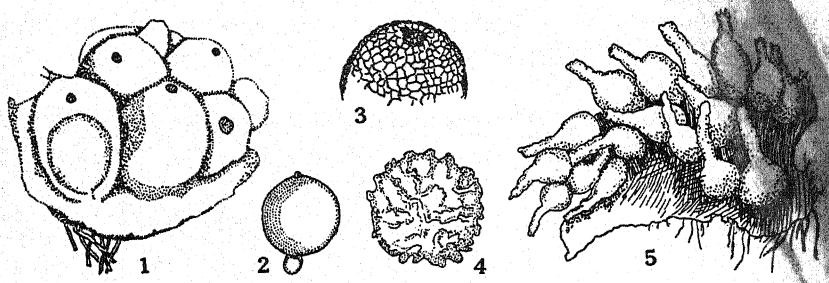
ILLUSTRATIONS: Haynes, Bull. Torr. Bot. Club 37: pl. 29-30, 1910; Rickett, Bull. Torr. Bot. Club 47:347-357, figs. 1-25, 1920; Allen, Proc. Amer. Phil. Soc. 58:289-316, figs. 1-4, 9-27, 1919. EXAMINATIONS:—*Fla.* Sanford (Rapp) 1912.

TYPE LOCALITY: Jacksonville, Florida. RANGE: Fla. (30), Ga. (2), S. C. (526).

5. Sphaerocarpus cristatus[123] Howe, Mem. Torr. Bot. Club 7:66, 1899.

Female thallus 3-8 mm wide, suborbicular, pale green when dry; lobes orbicular, ascending; marginal cells usually quadrate, 26-45 μ. Archegonial involucres 0.85-1.2 mm high, sessile, densely aggregated, cylindric to subglobose or obovoid, rounded at apex; mouth small; cells near mouth arcuate-protuberant, 26-40 μ. Antheridial thalli 2 mm long, cuneate, often forked; lobes ovate-oblong. Antheridial involucres 500-580 μ high, about 2.5 times as long as wide. Foot remaining in thallus when sporangium falls off. Sporangium 500-800 μ thick. Spores separating long before maturity of the sporangium, never persisting in tetrads, con-

[123]kris tā' tŭs.



Sphaerocarpus cristatus. 1, Female plant with involucres, x 15. 2, Sporophyte, x 15. 3, Mouth of female involucre, x 32. 4, Spore, outer face, x 260. 5, Antheridial plant with involucres, x 20. (1, 2, after Howe; the others after Haynes.)

pressed to rounded-biconvex or sometimes concavo-convex, yellowish brown or pale yellow, 52-80 μ, cristate; the crests sinuous to subcrenulate, 4-7 μ high, mostly radiating from near middle of each face, sparingly anastomosing, forming 1-6 or more closed meshes usually near middle of the face. L. *cristatus,* crested; referring to the spore surfaces.—On damp soil.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 100, figs. 1-8, 1899; Haynes, Bull. Torr. Bot. Club 37: pl. 31, 1910. EXAMINATIONS:—*Cal.* San Francisco (Sutliffe) 1928.

TYPE LOCALITY: Near Stanford University, California. RANGE: Cal. (264).

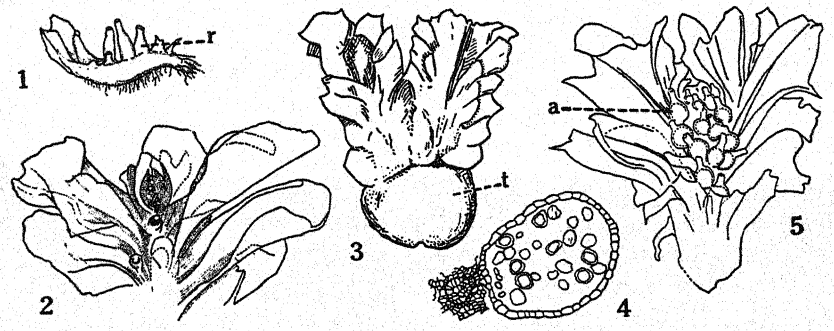
GEOTHALLUS[124] Campbell, Bot. Gaz. 21:13, 1896.

Thalli simple or dichotomous, composed of stem-like median axis with lateral lobes and sometimes dorsal ones; axis flattened, several cells thick, abruptly passing into lobes; lateral lobes leaf-like, crowded, large, irregularly succubous, mostly unistratose; dorsal lobes when present smaller than the lateral ones, irregularly disposed, leaf-like. Cells of the thallus thin walled. Rhizoids numerous, long, colorless. Plants unisexual. Female and antheridial plants similar, or the female slightly larger. Antheridia and archegonia usually few, often located near the axils of the leaf-like lobes, one or sometimes several enclosed in each involucre. Involucres unistratose, often flask-shaped. Archegonial involucres cylindric to somewhat flask-shaped, finally saccate to companulate; mouth large. Calyptra mostly of 2 layers of cells, rupturing rather late, the upper part remaining on the sporangium. Sporangium nearly spherical, indehiscent, containing spores and sterile cells; wall of 1 layer of cells, dark colored, without local thickenings of any kind. Sterile cells oval to ellipsoid-cylin-

dric, thin walled. Spores separate at maturity, very large, thick walled, the inner face reticulate, otherwise smooth. The name from Gk. *ge*, earth and *thallos*, a rootless stemless leafless plant; it is a thalloid plant although it almost reaches the development of a leafy stem.

1. **Geothallus tuberosus**[125] Campbell, Bot. Gaz. 21:13, 1896.

Plant simple or once dichotomous, 3-5 mm wide, 5-7 mm long, perennial through the conversion of a large part of its axis into an oval or flattened tuber. Lateral lobes leaf-like, nearly horizontal to nearly ascending, very variable in form, mostly oblong to obovate or linear-ligulate, 1.5-2 mm long, rarely wider than long, sometimes cristate-laminate at base, margins entire or slightly sinuate. Marginal cells of the lateral lobes



Geothallus tuberosus. 1, Vertical section of female thallus, (*r*) archegonial envelope, x 2.5. 2, End of branch of female plant, x 10. 3, Plant showing dichotomy, growing from tuber (*t*), x 4. 4, Longitudinal section of sporophyte, x 15. 5, Dorsal view of male plant, (*a*) antheridial envelope containing (dotted) antheridium, x 10. (All after Campbell.)

pentagonal or subquadrate-oblong, 50-65 x 35 μ; the submarginal ones hexagonal oblong or irregularly pentagonal, 50-100 x 35-60 μ, those toward the bases of the lobes often 200 μ long. Antheridial involucres 450 μ high. Seta about 90 μ long. Sporangium 800 μ thick. Sterile cells 48-108 μ long. Spores nearly black, up to 120-150 μ; spore wall smooth or very minutely punctulate, 8-12 μ thick except at the very small inner face where it is thinner and bears reticulate ridges; meshes about 15 μ. So named from its tuberous thallus.—On damp soil.

ILLUSTRATIONS: Campbell, Bot. Gaz. 21: pl. 2, 1896; Campbell, Ann. Bot. 10: pls. 24-25, 1896. EXAMINATIONS:—*Cal.* San Diego (A. W. Haupt) 1933.

TYPE LOCALITY: Near San Diego, California. RANGE: Cal. (296).

[125] tū bĕr ō' sŭs.

RIELLACEAE[126]

Plants aquatic, submersed, composed of a stem-like portion with 1-2 dorsal wings, without air chambers or pores. Stem elongate, cylindric, simple or branched, with latero-ventral scales; rhizoids mostly near base, ventral, with smooth walls; wing a leaf-like expansion, unistratose. Antheridia in rows in the outer margin of the wing, finally enclosed in pockets through the growth of the tissue immediately around them. Plants unisexual or bisexual. Archegonia in rows along the stem, acropetal in succession, each enclosed in a flask-shaped involucre. Seta short. Sporangium opening by decomposition or irregularly, containing some sterile cells among the spores but no elaters; its wall 1 cell thick, without spiral thickenings in the cells. Spores separating at maturity.

RIELLA[127] Mont., Ann. Sci. Nat., Ser. 3, 18:11, 1852.

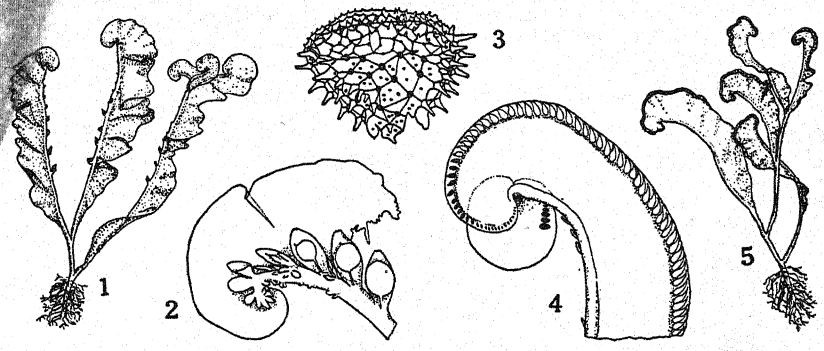
Duriaea Bory & Mont., Compt. Rend. Acad. Sci. Paris 16:1115, 1843; not of Merat, 1829.
Maisonneuvea Trev., Mem. Istit. Lomb. 13:442, 1877.

Thalli usually erect or suberect, submersed in fresh water, rarely floating, decumbent to prostrate as water subsides, commonly several times dichotomous, bilaterally symmetrical by arrangements of scales, rhizoids and sex organs. Cylindrical axis or stem with a dorsal leaf-like blade or wing. Wing one, or in *R. bialata* two, lengthwise, often undulate, 1 cell thick. Scales lanceolate or lingulate, latero-ventral, rudimentary to distinct; gemmae sometimes present, among the scales. Thalli unisexual or bisexual. Antherida in series on margin of the wing, becoming enclosed individually in pockets formed by local thickenings in the wing. Archegonia in series on the axis, in acropetal succession, each surrounded by a flask-shaped involucre. Involucres of the mature sporophytes ovoid or ellipsoid to subglobose, smooth or papillate, sometimes 8-winged, with small mouth. Seta short. Sporangium subglobose. Spores spinose or verrucose, often with basal reticulations.—Named in honor of Du Rieu de Maisonneuve, director of the Botanical Garden in Bordeaux.

1. **Riella americana**[128] Howe & Underw., Bull. Torr. Bot. Club 30:218, 1903.

Thalli erect or ascending, 10-30 mm high, simple or commonly 1-4 times dichotomous. Axis stem-like, elliptic in cross section, 200-800 μ wide, mostly 6-10 cells thick. Rhizoids only from basal region, usually few; wing 2-5 mm wide, rounded-falciform at apex, slightly undulate-

crisped, subentire or erose, tapering toward the base, commonly wanting below the first forking; cells of the wing about 60 μ in greatest diameter near the axis, those near the margin about 40 μ. Scales few, small, 200-600 μ long, lingulate and obtuse to irregularly lanceolate and subacute, those near the apex usually intermingled with multicellular gemmae. Gemmae hair-like in origin, soon oblong or orbicular-oblong in outline,



Riella americana. 1, Female thallus with sporophytes, x about 1.5. 2, Terminal portion of a branch of the female gametophyte, x 5.5. 3, Spore, side view, with the outer face more spiny than the inner face, x 210. 4, Terminal portion of a branch of the antheridial gametophyte, with a young branch at the apex, x 5.5. 5, Male thallus with antheridia along outer margin of wing, x about 1.5. (2, 4, after Howe & Underwood; the others after Studhalter.)

later showing a median constriction, finally becoming violin-shaped and subspatulate. Thalli unisexual. Antheridia 160 x 360 μ, sometimes as many as 75 including empty ones in a single elongated marginal series. Female gametophyte or its branches mostly maturing 3-12 sporophytes in acropetal order. Involucres smooth, ellipsoid-ovoid or when quite mature subglobose-ovoid, 1.4-1.8 x 0.8-1.2 mm, rather gradually narrowed to the truncate or slightly pointed subpapillose orifice. Seta about 200 μ long, mostly slightly shorter than the ovoid-conic foot. Sporangia globose, 0.8-1 mm in diameter. Spores 100-130 μ in longest diameter including the spines, dark brown; outer face spiny; spines curved, 10-24 μ long, dilated at tip, more or less connected by radiating basal membranes which form irregular reticulations; inner faces also spiny; their spines conic, not dilated at tip, 3-6 μ long, with basal membranes none to obsolescent. So named because it is the first North American species discovered.—Submerged in shallow pools.

ILLUSTRATIONS: Howe & Underwood, Bull. Torr. Bot. Club 30: pl. 11, pl. 12, figs. 21-22, 1903; Studhalter, Bot. Gaz. 92:172-191, figs. 1-25, 1931; Studhalter, Sci. Mo. 35:307, fig. 2, 1932. EXAMINATIONS:—*Tex.* Fort Davis (Studhalter 1955) 1934.

TYPE LOCALITY: Limpia Canyon, Texas. RANGE: S. D. (308), Tex. (494).

METZGERIACEAE[129]

Plants thalloid to leafy; thalloid plants with a vein, usually with a unistratose lamina but sometimes composed of vein only, without pores or special photosynthetic tissue; leafy plants with 2 or 3 rows of leaves; leaves all much alike. Vein always present, with or without a central strand. Lamina unistratose or wholly wanting. Margin variously lobed in those approaching the leafy species. Involucre not homologous with leaves. Archegonia arising behind the apical cells except in *Calobryum*. Sporangium with wall 2 or more cells thick or only 1 by resorption of the inner layer in maturity, opening by valves or by a single slit. Elaters present.

A. Plants without distinct leaves, although deeply lobed in some.
  B. Thallus without lamellae, sometimes lobed.
    C. Thallus not hairy on margin, not hairy on underside of vein or lamina except as rhizoids; antheridia and archegonia dorsal or on lateral branches.
      D. Scales wanting on the ventral surface; thallus not lobed or only irregularly so, without distinct dark spots in the tissue.
        E. Vein without a central strand or in *Moerckia flotoviana* with a faint one on each side of the vein.
          F. Antheridia and archegonia on short lateral branches of the thallus; elater bearers forming a tuft at the tip of the sporangium; wall of sporangium 2 cells thick, with or without semiannular thickenings..... *Riccardia*, p. 117
          FF. Antheridia and archegonia dorsal on the main body of the thallus; elater bearers forming a tuft at the base of the sporangium; wall of sporangium 2-3 cells thick, with or without semiannular thickenings..... *Pellia*, p. 125
          FFF. Antheridia and archegonia dorsal on the main body of the thallus; elater bearers none or too few to form a tuft at either end of the sporangium; wall of sporangium 3-6 cells thick, without semiannular thickenings..... *Moerckia*, p. 141
        EE. Vein with a single distinct central strand of narrow thick-walled cells..... *Pallavicinia*, p. 145
      DD. Ovate toothed scales present on the ventral surface; thallus rather regularly and distinctly lobed, with distinct dark spots in the tissue at base of lobes..... *Blasia*, p. 147
    CC. Thallus hairy on margins (in ours), hairy on under side of vein and sometimes of lamina with hairs too short to be distinctly rhizoids; antheridia and archegonia separate on very short rolled up ventral branches..... *Metzgeria*, p. 130
  BB. Thallus with lamellae on the dorsal surface of the lamina diagonally from the vein to near the margin, with distinct lobes..... *Petalophyllum*, p. 149
AA. Plants with distinct leaves; leaves in 2 rows, distinctly succubous..... *Fossombronia*, p. 151

[129] Proskauer, J. J. of M. 6.

RICCARDIA[130] S. F. Gray Nat. Arr. Brit. Pl. 1:683, 1821.

Romeria Raddi, Mem. Soc. Ital. Sci. Modena 18:48, 1820; not of Medic, in 1772.
Aneura Dum. Comm. Bot. 115, 1822.
Trichostylium Corda, Opiz, Beitr. 1: 1829.
Acrostolia Dum. Rec. d'Obs. 1835.
Sarcomitrium Corda, Sturm Deutschl. Fl. 2:120, 1836.
Pseudoneura Gottsche Mex. Leberm. 259, 1863.
Spinella Schiffn. Exped. Gazelle 42, 1889.

Thalli prostrate and rhizoidous beneath, or ascending from a rhizomatous base, simple or branched, sometimes regularly pinnate, not branching from the ventral side, fleshy. Vein indistinct, terete to flattish, either constituting the whole body or the thallus also with a thin margin. Unistratose margin when present narrow, continuous or discontinuous, sometimes present only on the smaller branches. Cross section almost circular to flat, interior cells commonly 2-4 times as large as the epidermal ones. Epidermal cells of the thicker part about the same as the cells of the unistratose part (when present). Thalli unisexual or bisexual; reproductive branches short. Male branches narrowed at base; their margins rolled upward and enwrapping the antheridia; antheridia on the upper side, sunken, sessile, often so crowded that their individual chambers are separated by only a single layer of cells. Female branches often eventually becoming apparently ventral through the growth of the dorsal surface of the thallus, constituting a receptacle; receptacle small, hairy, bearing archegonia on a ventral ridge; archegonia free or among hairs or scales, on the dorsal side. Calyptra very large, thick, fleshy, often papillose outside and with a small crown of papillae on the tip. Seta long. Sporangium ovoid to almost cylindrical, deeply 4-valved, its wall 2 cells thick; wall cells various in kind of thickenings and the location of these. Elater bearers persistent as erect tufts on the apices of the valves.—We do not know after whom the genus was named.

Stephani subdivides the genus on the form of their thalli and their sexuality. It seems to us that the primary separation into related groups will eventually be on the form and location of the thickenings in the wall of the sporangium. The scarcity of sporangia in certain species has perhaps delayed this, and makes keys by vegetative characters almost indispensable.

A. Key by the sporangia and thalli.
  B. Epidermal cells of the sporangium without nodular thickenings, with distinct semiannular thickenings.
    C. Inner wall of the sporangium without semiannular thickenings.
      D. Inner wall of the sporangium without nodular thickenings; margin of the ultimate thallus branches unistratose for 2-3 cells in width..... 1. *R. multifida.*
      DD. Inner wall of the sporangium with faint nodular thickenings; margin of the ultimate thallus branches not unistratose at all..... 2. *R. palmata.*
    CC. Inner wall of the sporangium with distinct semiannular thickenings..... 3. *R. sinuata.*

[130] rĭk kär' dĭ ă. S. F. Gray spelled it *Riccardius.* This was changed to the present feminine form by Carrington, Trans. Bot. Soc. Edinburgh 10:305-309, 1870.

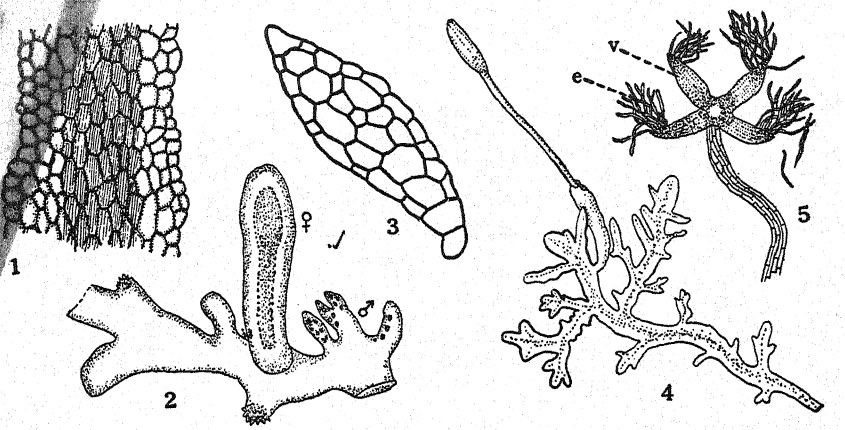
BB. Epidermal cells of the sporangium with nodular thickenings on the radial walls, with faint or no semiannular thickenings.
E. Epidermal cells of the sporangium with faint semiannular thickenings; main body of the thallus 0.8-2 mm wide, 5-6 cells thick in the middle..... 4. *R. latifrons.*
EE. Epidermal cells of the sporangium without semiannular thickenings; main body of the thallus 2-10 mm wide, 10-15 cells thick in the middle..... 5. *R. pinguis.*
AA. Key by the thalli only (and less dependable).
F. Main body of the thallus 5-9 cells thick in the middle, 2 mm or less wide.
G. Margin of the ultimate branches of the thallus unistratose for 2-3 cells in width..... 1. *R. multifida.*
GG. Margin of the ultimate branches of the thallus unistratose for 0-1 cell in width.
H. Thallus palmately branched.
I. Branches of the thallus 200-350 μ wide; main body of thallus 2-3 times as wide as thick..... 2. *R. palmata.*
II. Branches of the thallus 800-2000 μ wide; main body of thallus 5 or more times as wide as thick..... 4. *R. latifrons.*
HH. Thallus pinnately or bipinnately branched..... 3. *R. sinuata.*
FF. Main body of the thallus 10-15 cells thick in the middle, 2-10 mm wide..... 5. *R. pinguis.*

1. Riccardia multifida[131] (L.) S. F. Gray Nat. Arr. Brit. Pl. 1:683, 1821.

Jungermannia multifida L. Sp. Pl., Ed. 2, 1602, 1762.
Roemeria multifida Raddi, Mem. Soc. Ital. Sci. Modena 18:36, 1818.
Aneura multifida Dum. Comm. Bot. 115, 1822.
Gymnomitrion multifidum Heuben. Hep. Germ. 37, 1834.
Aneura multifida var. *ambrosioides* Nees Naturg. Eur. Leberm. 3:450, 1838.
Jungermannia incisa Tayl. & Hook., London Jour. Bot. 4:93, 1845; not of Schrad. System. Samml. Krypt. Gew. 2:5, 1796.
Aneura multifida var. *submersa* Tayl., London Jour. Bot. 4:94, 1845.
R. multifida var. *ambrosioides* Lindb., Acta Soc. Sci. Fennica 10:511, 1875.
Aneura ambrosioides Pears. Hep. Brit. Isles 453, pl. 201, 1902.

Thalli prostrate, dark green to brownish green, regularly 2-3 pinnate, up to 1.5-3 cm long; its branches crowded, linear, narrowed toward tip, rounded or emarginate at apex, 300-500 μ wide. Epidermal cells polygonal, 1-2 times as long as wide, thin walled, their angles slightly thickened. Margin more or less crenulate, translucent, unistratose for 2-3 cells of its width. Cross section biconvex or rarely only the under side bulging, 5-7 cells thick in the middle, the inner cells much larger than the outer ones. Gemmae oval-oblong, at the ends of the branches, 2-celled. Thalli bisexual. Male branch oblong, crenulate at margin. Female branch with several short laciniae; archegonia surrounded by curved multicellular hairs. Calyptra 3-6 mm long, narrowly clavate, papillose. Seta 2 cm long. Sporangium cylindric, dark brown; its epidermal cells with wide distinct semiannular thickenings; its inner cells of the wall without semiannular thickenings. Elaters 250-300 μ long, 12-15 μ wide; spiral reddish brown. Spores 13-16 μ, pale yellowish brown, nearly smooth, translucent. L.

[131] Plate 11, fig. 1.



Riccardia multifida. 1, Piece of branch showing translucent margins, x 60. 2, Part of thallus, reproducing, x 10. 3, Cross section of thallus, x 80. 4, Thallus, x about 2. 5, Open sporangium, (*v*) valve, (*e*) elater bearers, x about 7. (2, after Pearson; 4, after Ekart; 5, after Hooker; the others after K. Mueller.)

multus, many and *fidi,* to split or cleave; in reference to the usually many segments into which the thallus is divided.—On wet ground; on wet rocks; on rotting wood in swamps.

ILLUSTRATIONS: Hooker (285) pl. 45; Ekart, Syn. Jung. Germ. pl. 13, fig. 109, 1832; Pearson (433) pls. 200-201; K. Mueller (409) 1: fig. 202; Macvicar (374) 54, figs. 1-3. EXAMINATIONS:—*N. C.* Winston-Salem (Chapman) 1922.—*Ida.* Moscow (Clark) 1923.—*Wash.* Pacific Beach (Foster) 1911; Granite Falls (Frye) 1934.—*Ore.* Otter Rocks (Daugherty) 1921; Larch Mt. (Reed College collection) 1934.—*Cal.* Smith River (Rakestraw) 1936.—*Fla.* Sebring (McFarlin 1323) 1936.

TYPE LOCALITY: European. RANGE: Greenland (340), Newfoundland (212), Cape Breton Isl. (413), N. S. (212), Me. (140), N. H. (359), Vt. (241), Mass. (232), R. I. (203), Conn. (212), N. Y. (58), Ont. (431), Pa. (338), Mich. (415), Ill. (529), Wis. (486), Alaska (173), B. C. (508), Ida. (81), Wash. (263), Ore. (457), Cal. (296), Fla. (266), Tenn. (464), N. C. (43), Ky. (218), W. Va. (466), Va. (127), N. J. (504); Bermuda (146); S. Amer. (401); Hawaii (173); Asia (325); Eur. (285); Africa (393); Kerguelen Isl. (392).

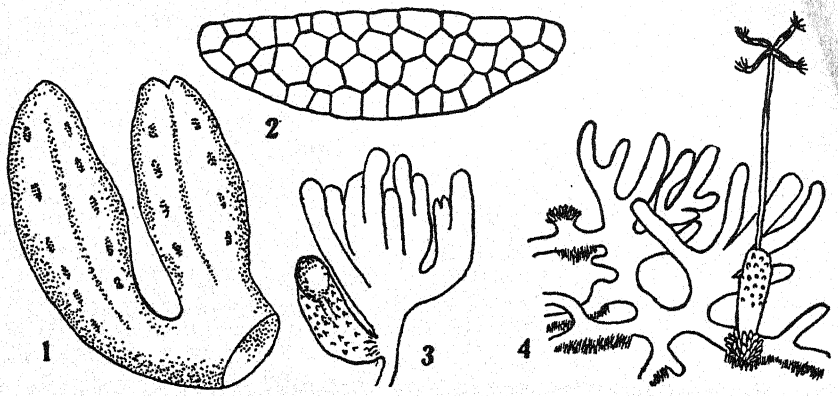
2. Riccardia palmata[132] (Hedw.) Carruth., in Seem. Jour. Bot. 3:302, 1865.

Jungermannia multifida of Hook., Brit. Jung. pl. 19, 1816; not of L. Sp. Pl., Ed. 2, 1602, 1762.
Jungermannia palmata Hedw. Theor. Gen., Ed. 1, 87, pl. 18, 1784.
Roemeria palmata Raddi, Mem. Soc. Ital. Sci. Modena 18:47, 1820.
Aneura palmata Dum. Comm. Bot. 115, 1822.
Sarcomitrium palmatum Corda, Sturm Fl. Germ. 2:120, 1832.
Jungermannia multifida var. *palmata* Nees, Mart. Fl. Bras. 1:326, 1833.
Gymnomitrium palmatum Hueben. Hep. Germ. 40, 1834.
Aneura palmata var. *polyblasta* G. L. & N. Syn. Hep. 498, 1844.

Thalli somewhat ascending from a prostrate main stem, dark green or the basal portion brown, opaque, 5-10 mm long; their branches some-

[132] păl mā' tă.

what palmately and pinnately arranged, narrowly linear, often again branched, up to 5 mm long and 200-350 μ wide, somewhat narrower toward tip and here and there involute. Gemmae round or oblong, at apices of branches. Epidermal cells comparatively small, polygonal but slightly rounded; wall thick and in older parts reddish brown. Margin



Riccardia palmata. 1, Two antheridial branches, x 48. 2, Cross section of thallus, x 200. 3, Thallus bearing young sporophyte, x 12. 4, Thallus with open sporangium, x 7. (1, after Pearson; 2, after K. Mueller; 3, after Meylan; 4, after Casares-Gil).

several cells thick. Cross section biconvex, 6-9 cells high in the middle, rounded at sides, the inner cells distinctly larger than the outer ones; apical branches 4 cells thick in the middle. Thalli unisexual. Male branches oval to linear, thick, with incurved and crenulate margins, with few short lacineae. Female branches short, from the main axis; archegonia terminal, surrounded by hairs; these hairs colorless, short, thick, of several cells, curved inward. Calpytra 2 mm long, cylindric, strongly papillose. Epidermal cells of sporangium with semiannular thickenings. Inner cells of wall of sporangium without semiannular thickenings, with slight nodular thickenings. Elaters 10-12 μ wide; spiral about 7 μ wide, reddish brown. Spores 12-15 μ, brown, almost smooth. So named from the usual palmate branching.—On rotting logs and on peat.

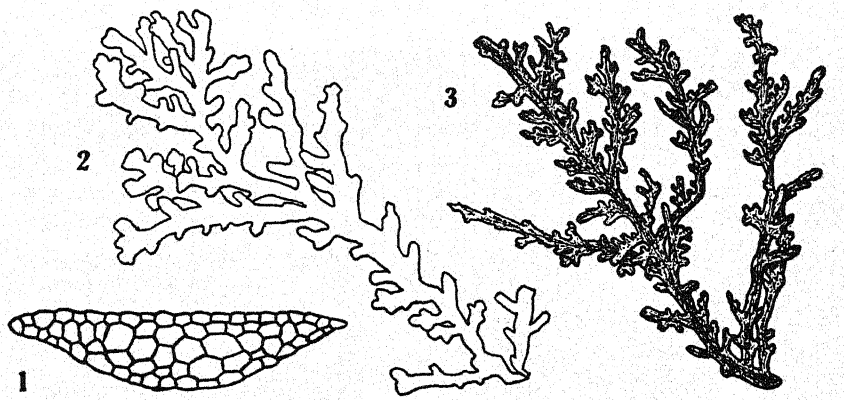
ILLUSTRATIONS: Pearson (433) pl. 199; Ekart, Syn. Jung. Germ. pl. 13, fig. 115, 1832; K. Mueller (409) 1: fig. 205; Macvicar (374) 57, figs. 1-4; Gil (76) fig. 178; Meylan (386) fig. 42A. EXAMINATIONS:—*N. Y.* Little Moose Lake in Herkimer County (Haynes) undated.—*Alaska.* Copper Center (Paul Thompson) 1933.—*Wash.* Kalaloch (Frye) 1931.

TYPE LOCALITY: European. RANGE: N. S. (413), Cape Breton Isl. (49), N. B. (309), Me. (150), N. H. (142), Vt. (171), Mass. (169), R. I. (203), Conn. (212), N. Y. (359), Pa. (237), Ont. (431), Mich. (485), Wis. (98), Alaska (373), B. C. (309), Ida. (81), Wash. (81), Ore. (81), Cal. (290), Ark. (46), Fla. (266), N. C. (309), W. Va. (338), D. C. (343); Bermuda (391); Cuba (433); Mex. (224); S. America (407); Peru (124); Asia (212).

3. **Riccardia sinuata**[133] (Dicks.) Trev. Schema Nuov. Class. Epat. 431, 1877.

Jungermannia sinuata Dicks. Crypt. fasc. 2:16, 1790.
Jungermannia multifida var. *sinuata* Hook. Brit. Jung. pl. 45, fig. 2, 1816.
Aneura sinuata Dum. Comm. Bot. 115, 1822.
Aneura pinnatifida Dum. Rec. d'Obs. 26, 1835.
Aneura multifida var. *major* Nees Naturg. Eur. Leberm. 3:450, 1838.
Aneura pinnatifida var. *composita* G. L. & N. Hep. Eur. 495, 1844.
R. latifrons var. *sinuata* Lindb. Hep. Hibern. Lect. 513, 1874.
R. major Lindb. Musc. Scand. 5, 1879.
Aneura major[134] K. Muell., Rabenhorst Krypt.-Fl. 6 (1):340, 1908.

Thalli pale green, various in form, usually 1-3-pinnate, up to 1.5-4 cm long, somewhat brittle; its branches various in length, usually about equally wide, sometimes narrowed at base, 0.5-1.5 mm wide. Epidermal cells 1.5-2 times as long as wide, polygonal, thin walled. Margin entire or sinuate, unistratose for the width of 0-1 cell, not hyaline. Cross section slightly bulging on both sides or flat to concave above, 5-9 cells high in the middle of the main thallus, sometimes in the branches as few as 3-4 cells,



Riccardia sinuata. 1, Cross section of thallus, x 60. 2, 3, Plants, x 1.5. (All after K. Mueller.)

the inner cells larger than the outer; oil cells usually present. Thalli bisexual. Male branch ventral in origin, short, ovate, crenulate at margin; antheridia 3-4 pairs. Female branch with papillose margin, not laciniate; archegonia on upper part, surrounded by hair-like cells. Calyptra 2-6 mm long, arcuate, cylindric-clavate, papillose. Sporangium oblong-cylindric, yellowish brown to dark brown; epidermal cells of sporangium with wide semiannular thickenings; inner cells of wall of sporangium with pale narrow semiannular thickenings. Elaters 280-500 μ long, 10-14 μ wide, red-

[133] sĭn ū ā' tă.
[134] Macvicar gives this the rank of a species. In our opinion it is not even of varietal rank. The material which many authors refer to *R. major* consists of plants with main shoots 5-6 cells thick and more of a tendency toward irregular branching. Neither character is fixed, nor is either one free from variation with habitat.

dish brown; the spiral about 12 μ wide. Spores 12-21 μ, pale greenish brown, thickly and minutely verruculose. The name from the often sinuate branches.—On dripping rocks, or on wood in very wet places.

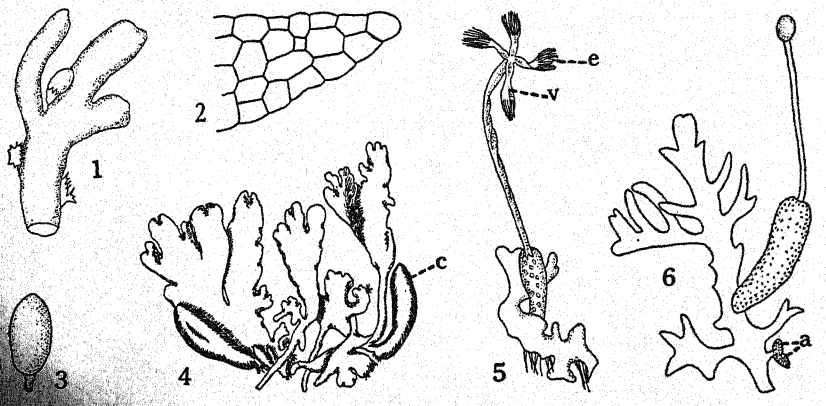
ILLUSTRATIONS: K. Mueller (409) 1: fig. 203; Macvicar (374) 55, figs. 1-3. EXAMINATIONS:—*Alaska.* Farragut Bay (Kincaid) 1899.—*Wash.* Friday Harbor (Clark) 1923; Orcas Island (Daugherty) 1923; Lapush (Frye) 1927.—*Ore.* Otter Rocks (Daugherty) 1921; Oregon Caves (Frye) 1931; O'Brien (Rakestraw) 1935; Port Orford (Rakestraw) 1935; Wedderburn (Rakestraw) 1936.—*Cal.* Smith River (Rakestraw) 1935.

TYPE LOCALITY: European. RANGE: N. S. (413), Cape Breton Isl. (413), N. Y. (258), Mass. (9), R. I. (150), Conn. (169), N. J. (212), Va. (271), N. C. (43), Alta. (51), Alaska (81), B. C. (373), Wash. (81), Ore. (239), Cal. (296); Asia (212); Eur. (409); Canary Isl. (325).

4. **Riccardia latifrons**[135] **Lindb., Not. pro Fauna et Fl. Fennica 13:372, 1874.**

Aneura palmata var. *major* Nees Naturg. Eur. Leberm. 3:459, 1838. Not *Aneura multifida* var. *major* Nees (*Aneura major* K. Muell.; *R. major* Lindb.) (See *R. sinuata*).
Aneura palmata of Hartm. Skand. Fl., Ed. 10, 152, 1871; not of Dum. Comm. Bot. 115, 1822.
Aneura latifrons Lindb., Bot. Not. 62, 1873.

Thalli prostrate with ascending branches, bright green, shining, opaque, irregularly pinnate to palmate, often also divided somewhat stag-horn-like, up to about 5-8 mm long; its parts 1-2 mm wide, various on same plant, wider toward their tips but often a little constricted at their extreme tips. Gemmae oval, at apex of branches. Epidermal cells 5-6-angled, with thin walls, large. Margin unistratose for 1 cell wide or less.



Riccardia latifrons. 1, Portion of thallus, x about 6. 2, Cross section of thallus, x 120. 3, Sporangium, x 12. 4, Plant, (*c*) calyptra, x 4. 5, Plant with open sporangium, (*v*) valve, (*e*) elater bearers, x about 3. 6, Bisexual plant, (*a*) antheridial branches, x 4.5. (6, after Meylan; 2, 4, after K. Mueller; the others after Pearson.)

Cross section plano-convex, 5-6 cells thick in the middle, inner cells larger than the outer ones. Thalli bisexual. Male branches oval, usually near the female branches. Female branches bud-like, with long laciniae. Calyptra up to 5 mm long and 800 μ wide, cylindrical or club-shaped, strongly papillose. Epidermis of sporangium with nodular thickenings along the radial cell walls, or with indistinct semiannular thickenings. Inner layer of the wall with semiannular thickenings; these numerous, very distinct, wide, brown. Elaters 10-12 μ wide; spiral 1, about 7 μ wide, reddish brown. Spores 14-17 μ, slightly papillose, yellowish brown. Name from L. *lata,* wide, and *frons,* a body neither distinctly a leaf nor a shoot; referring to the thallus.—On decaying wood in wet places.

ILLUSTRATIONS: Pearson (433) pl. 202; K. Mueller (409) 1: fig. 204; Macvicar (374) 56, figs. 1-3; Meylan (386) fig. 41. EXAMINATIONS:—*N. Y.* Little Moose Lake in Herkimer County (Haynes 1254) 1910.—*Mich.* Cheboygan (Woollett) 1923.—*Wyo.* Yellowstone Nat. Park (Frye) 1925.—*Mont.* Henderson (Frye) 1925.—*B. C.* Jordan River (Frye) 1923.—*Wash.* Pacific Beach (Foster) 1911; Stevens Pass (Frye) 1932.—*Ore.* Port Orford (Rakestraw) 1935.—*Cal.* Crescent City (Frye) 1930.

TYPE LOCALITY: The mineral wells at Godesberg near Bonn, Germany. RANGE: Newfoundland (212), Anticosti (431), Miquelon Isl. (433), Cape Breton Isl. (413), Prince Edward Isl. (373), N. S. (413), N. B. (369), Me. (254), N. H. (359), Vt. (199), Mass. (6), R. I. (203), Conn. (140), N. Y. (64), Que. (178), Pa. (338), Ont. (373), Mich. (415), Ill. (529), Wis. (98), Wyo. (446), Mont. (81), Alta. (51), Alaska (135), B. C. (508), Ida. (81), Wash. (81), Ore. (263), Cal. (290), Fla. (337), Ga. (52), N. C. (12), Ky. (218), W. Va. (466), Va. (127), Md. (444); Bermuda (146); Asia (325); Eur. (338).

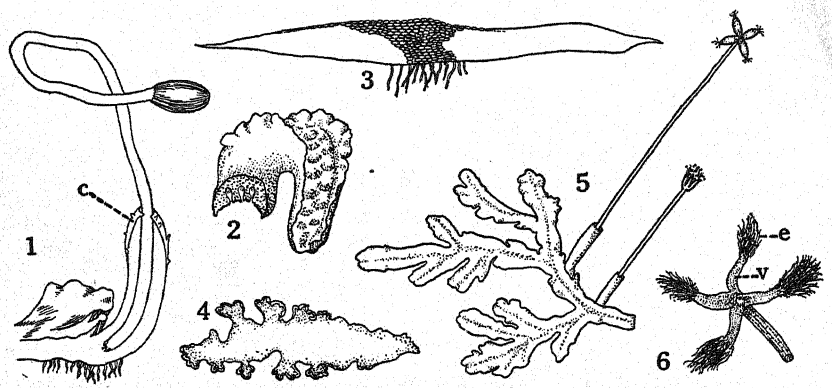
5. Riccardia[136] pinguis[137] (L.) S. F. Gray Nat. Arr. Brit. Pl. 1:683, 1821.

Jungermannia pinguis L. Sp. Pl. 1:1136, 1753.
Jungermannia pinguis var. *angustior* Hook. Brit. Jung. pl. 46, fig. 2, 1816.
Roemeria pinguis var. *media* Raddi, Mem. Soc. Ital. Sci. Modena 18:48, 1820.
Roemeria pinguis var. *minor* Raddi, Mem. Soc. Ital. Sci. Modena 18:48, pl. 7, fig. 3 (upper), 1820.
Roemeria pinguis var. *major* Raddi, Mem. Soc. Ital. Sci. Modena 18:48, pl. 7, fig. 2a, 1820.
Aneura pinguis Dum. Comm. Bot. 115, 1822.
Aneura sessilis Spreng. Syst. Veg. 4:232, 1827.
Metzgeria pinguis Corda, Opiz, Beitr. 1:654, 1829.
Gymnomitrion pingue Hueben. Hep. Germ. 41, 1834.
Gymnomitrion pingue var. *angustum* Hueben. Hep. Germ. 41, 1834.
Trichostylium affine Corda, Sturm Fl. Germ. 2:116, pl. 34, 1836.
Trichostylium arenarium Meyen, Mueller in Archiv. f. Anat. und Physiol. 273, 1839.
Jungermannia rigida Wallr., Linnaea 14:685, 1840.
R. fuscovirens Lindb. Musc. Skand. 5, 1879.
Aneura latissima Spruce, Trans. Edinburgh Bot. Soc. 544, 1885.

Thalli deeply bluish green to yellowish green, blackish green when dry, with an oily lustre, variable in form, simple or with few and usually irregular lateral branches, 2-6 cm long, narrowly ligulate, thick, somewhat brittle when turigd, its parts 2-10 mm wide. Epidermal cells polygonal,

[136] As *Riccardius.*
[137] ping' wis.

isodiametric, thin walled, smaller than the interior cells. Margin ascending, crisped or occasionally flat, 1-3-stratose. Rhizoids many, short, median, extending almost to the tip. Cross section biconvex or slightly bulging beneath, 10-15 cells thick in the middle, gradually thinner toward the margins. Thalli unisexual. Male plants less robust, often only 7-8 cells thick; antheridial branches oblong, sometimes in pairs, lateral, crenulate or dentate at margin, with 3-4 pairs of antheridia. Female branch from



Riccardia pinguis. 1, Part of plant, (*c*) calyptra, x about 2.5. 2, Antheridial branch, x about 30. 3, Cross section of thallus, x about 12. 4, Plant with male branches, x about 1.5. 5, Plant with open sporangia, x about 0.5. 6, Open sporangium, (*v*) valve, (*e*) elater bearers, x about 2.5. (5, after Raddi; 4, 6, after Hooker; the others after Sullivant.)

the base of a sinus, covered by the margin of the thallus, with short laciniae at apex. Calyptra up to 1 cm long and 1.5 mm in diameter, its wall 15-18 cells thick, smooth outside, scaly from base often to the tip; these scales numerous, with staghorn-like branching, originating at the base of the archegonium, carried upward upon it by later subarchegonial growth. Seta 2-5 cm long. Sporangium oblong, chestnut brown. Epidermal cells of sporangium with nodular reddish brown thickenings on the radial walls. Inner layer of wall cells with semiannular thickenings; these distinct, stout, reddish brown. Elaters whip-like in form, narrowed at both ends, about 10 μ wide in the middle, grouped in a small brush 1-1.2 mm long at the upper end of the valves of the sporangium; spiral 1 or rarely sporangia occur having 2, reddish brown, 7-9 μ wide. Spores 20-25 μ, reddish brown, finely minutely papillose. L. *pingis,* fat; in reference to its fatty luster.—On wet banks and in swamps on humus.

ILLUSTRATIONS: Hooker, Brit. Jung. pl. 46, 1816; Ekart, Syn. Jung. Germ. pl. 2, fig. 21, and pl. 13, fig. 110, 1832; Sullivant, Mem. Amer. Acad., N. Ser., 3: pl. 5, 1848; Pearson (433) pl. 204; K. Mueller (409) 1: fig. 200; Macvicar (374) 51, figs. [illegible] Raddi, Mem. Soc. Ital. Sci. Modena 18: pl. 7, fig. 2, 1818; Kurz & Little, Bull. [illegible] State College for Women 26 (3) :28, fig. 14, 1933. EXAMINATIONS:—*Wash.*

Orcas Island (Clark) 1923.—*Cal.* Shasta City (Pendleton) 1914.—*Fla.* Sebring (McFarlin 1324) 1936.

TYPE LOCALITY: European. RANGE: Greenland (248), N. S. (53), Cape Breton Isl. (413), Que. (178), Me. (155), N. H. (359), Vt. (241), Mass. (456), R. I. (203), Conn. (169), N. Y. (341), Pa. (504), Ont. (431), Ohio (495), Mich. (502), Ind. (529), Ill. (529), Wis. (486), Athabasca (373), Alta. (51), Yukon (51), Alaska (212), B. C. (373), Wash. (81), Ore. (457), Cal. (310), Okla. (354), La. (495), Fla. (337), N. C. (43), Tenn. (12), Ky. (218), W. Va. (466), N. J. (504); W. Indies (212); Mex. (224); S. Amer. (55); N. Z. (491); Australia (212); Java (491); Asia (350); Eur. (329); Africa (212); Madagascar (491).

PELLIA[138] Raddi, Mem. Soc. Ital. Sci. Modena 18:38, 1818.

Jungermannia L. Sp. Pl., Ed. 1, 1135, 1753, in part.
Papa S. F. Gray Nat. Arr. Brit. Pl. 1:686, 1821.
Scopulina Dum. Comm. Bot. 115, 1822.
Blasia Fries Stirp. Fremson. 31, 1825.
Gymnomitrion Hueben. Hep. Germ. 42, 1834.

Thalli large, fleshy, commonly several times dichotomously branched, the under side prominently projecting. Vein wide, indistinct, gradually grading into the 1-celled margin. Margin somewhat undulate. Rhizoids numerous, from the vein. Ventral scales wanting. Gemmae wanting; vegetative reproduction through innovations from the apex or from the under side of the vein. Antheridia on the dorsal surface of the vein, with short stalk, usually immersed singly in hollows in the thallus; the hollows with a single narrow pore; mouth of the pore on a dome-shaped or conical elevation. Archegonia in groups of 4-12, in the median region of the upper side, in pocket-like cavities opening toward the front, or in cup-shaped or tubular cavities. Calyptra immersed or exserted. Seta long, up to 10 cm, translucent. Sporangium spherical, yellowish green; its wall of 2 or more layer of cells, with or without semiannular thickenings; opening by 4 valves almost to the base. Elater bearers 20-100, attached to the base of the sporangium; elaters with 2-3 spirals. Spores very large, multicellular.—Named in honor of Leopoldo Pelli-Fabbroni, a lawyer of Florence, Italy, and a friend of Raddi.

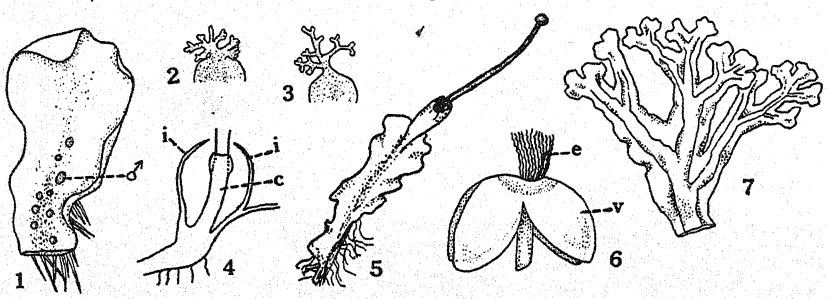
Longitudinal section of vein without band-like thickenings; calyptra immersed; elater bearers about 100, 5-8 μ thick; elaters 150-200 μ long..... 1. *P. endiviaefolia.*
Longitudinal section of vein showing band-like thickenings; calyptra exserted; elater bearers 20-30, 15-25 μ thick; elaters 225-500 μ long.
  Thalli 3-7 mm wide, unisexual; involucre a tube shorter on the front side of the seta..... 2. *P. neesiana.*
  Thalli 10-15 mm wide, bisexual; involucre a scale just behind the seta..... 3. *P. epiphylla.*

[138]pĕl' lĭ ă. There are only these 3 species of *Pellia.*

1. Pellia endiviaefolia[139] **(Dicks.) Dum. Rec. d'Obs. 27, 1835.**

Jungermannia endiviaefolia Dicks. Pl. Crypt. Fasc. 4:19, 1801.
Jungermannia epiphylla var. *longifolia* Hook. Brit. Jung. pl. 47, 1816.
Jungermannia epiphylla var. *fucigera* Hook. Brit. Jung. pl. 47, 1816.
P. fabbroniana[140] Raddi, Mem. Soc. Ital. Sci. Modena 18:38, pl. 7, fig. 5, 1818.
Jungermannia calycina Tayl., Mackay Fl. Hibern. 2:55, 1836.
P. calycina Nees Naturg. Eur. Leberm. 3:386, 1838.
P. fuciformis Nees Naturg. Eur. Leberm. 3:388, 1838.
Marsilia endiviaefolia Lindb. Musc. Scand. 10, 1879.
P. fabbroniana f. *furcigera* Massal. Rep. Ep. Ital. 46, 1886.

Thalli prostrate or ascending, usually forming mats, dark green, rarely tinged with reddish brown, often considerably branched, very often repeatedly forking in the fall, 1-2.3 cm long, 4-8 mm wide, delicate, collapsing when removed from a water habitat. Vein flat or convex on under side, without band-like thickenings. Margin somewhat translucent,



Pellia endiviaefolia. 1, Part of male plant, x 1.3. 2, 3, Forms sometimes assumed by the tips of the branches, x 1.3. 4, Diagram of vertical section through (*i*) involucre, (*c*) calyptra. 5, Plant with sporangium, x 1. 6, Sporangium open, with reflexed valves, (*v*) valves, (*e*) elater bearers, x 6.7. 7, Form sometimes assumed by the tip of the thallus, x about 1. (7, after Hooker; 2, 3, after Casares-Gil; 4, 5, after K. Mueller; 1, 6, after Pearson.)

thin, undulate, sometimes crisped toward tip. Rhizoids numerous, brown, on the vein beneath. Cross section 8-16 cells thick in the middle. Thalli unisexual. Male plants always in separate patches but often near the female ones. Involucre nearly erect, tubular, up to 5 mm long; its mouth incurved at first, lobed, the lobes ciliate or laciniate. Calyptra immersed or rarely exserted, about 3 mm long, cylindrical with expanded mouth, glabrous. Seta long. Sporangium spherical, olive green, becoming light brown, its walls 2 cells thick. Epidermal cells of the sporangium large, with nodular thickenings at the angles. Inner wall cells of the sporangium smaller than the outer, without semiannular or nodular thickenings. Elater-bearers about 100, on the base of the sporangium, with 2 spirals, 600-800 μ long, 5-8 μ wide; elaters vermiform, 150-200 μ long, hardly contorted, 10-12 μ wide, with 3-4 spirals. Spores elliptical, 70-80 x 35-45 μ,

[139] "Pe" di vi e fo' li ă. Dickson's name seems to have the priority. It is generally conceded that he probably had this species. While he did not clearly differentiate it from others, the same may be said of many hepaticae described in the years 1753 to 1815 inclusive.
[140] Raddi spells the name with only one "b."

thin, undulate, sometimes crisped toward tip. Rhizoids numerous, brown, greenish, finely papillose. Ital. *endivia,* endive, and L. *folia,* leaf; in reference to its occasionally rather finely divided thalli.—On wet rocks or in wet places on soil.

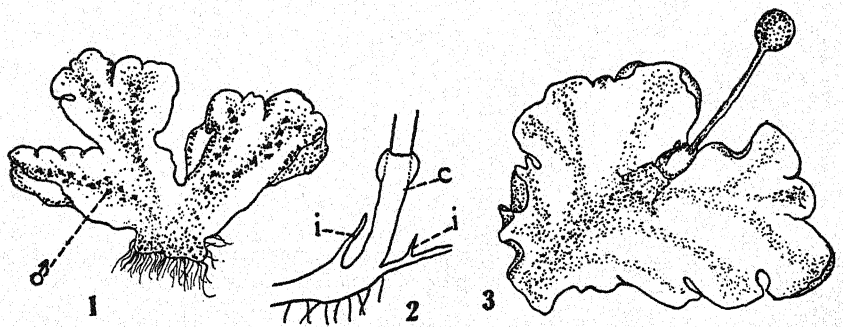
ILLUSTRATIONS: Hooker, Brit. Jung. pl. 47, fig. 18, 1816; Jack, Flora 81: pl. 1, figs. 7-14, 1895; Pearson (433) pl. 198; Warnstorf (523) 106, figs. 3e-3f; K. Mueller (409) 1: fig. 219; Macvicar (374) 74, figs. 1-3; Gil (76) fig. 188. EXAMINATIONS:—*N. C.* Winston-Salem (Schallert) 1924.—*Wyo.* Yellowstone Nat. Park (Porter) 1934; Centennial (Frye) 1934.—*Mont.* Libby (Frye) 1928; Glacier Nat. Park (Frye) 1929.—*Ida.* Payette Nat. Forest (Miller) 1934.—*Wash.* Orcas Island (Millican) 1925; Lapush (Frye) 1927; Mt. Baker (Howell) 1931.—*Ore.* Cape Arago (Frye) 1932.—*Cal.* Hydesville (Frye) 1933.

TYPE LOCALITY: Dickson's work is not available to us. RANGE: Labrador (510), N. S. (413), Cape Breton Isl. (413), N. H. (185), Vt. (244), Conn. (159), N. Y. (4), Mich. (415), Wis. (98), Wyo. (81), Mont. (81), Alta. (51), Alaska (135), B. C. (431), Ida. (508), Wash. (81), Ore., Cal., N. C. (10), Va. (271), W. Va. (468); Asia (387); Eur. (458).

2. **Pellia neesiana**[141] (Gottsche) Limpr., Cohn Krypt. Fl. Schles. 1:329, 1876.

P. epiphylla forma *neesiana* Gottsche, Hedwigia 6:69, 1867.
Marsilia neesii Lindb. Musc. Scand. 10, 1879.
P. endiviaefolia of Underw. in Gray's Manual, Ed. 6, 724, 1889; not of Dum. Rec. d'Obs. 27, 1835.
P. neesii Limpr., Kaalaas Leverm. Norge 456, 1893.

Thalli prostrate, forming mats, dark green, nearly always tinged with dark red specially on the vein, translucent toward the margin, cuneate,



Pellia neesiana. 1, Antheridial plant, x 2.7. 2, Diagram of vertical section through (*i*) involucre, (*c*) calyptra. 3, Female plant, x 2.7. (2, after K. Mueller; the others after Sanborn.)

branching rather sparse, dichotomous; segments oblong to linear, 7-15 mm long, 3-7 mm wide, firm, not collapsing. Margin plane or often undulate. Rhizoids numerous, brownish white. Cross section 10-12 cells thick in the middle, with interlacing bands in the cells; in median longitudinal section with mostly vertical band-like thickenings in the cells. Thalli uni-

[141] nēs ĭ ān' ă.

sexual. Male plant usually growing with the female one, or in separate patches. Involucre low, dorsal, smooth, forming a complete ring but lower on the front side, sometimes split on the front side, cylindrical, longitudinally plicate; its mouth truncate, entire to crenulate or crenate-lobulate. Calyptra usually exserted, sometimes included, 5 cells thick at base and 2 at apex, rough through scattered 2-celled hairs. Seta hyaline, delicate, up to 4 cm long. Sporangium spherical, pale brown, cleft nearly to base; valves 4, ovate, equal. Epidermal cells of sporangium with nodulose thickenings in the walls, the walls thickened at the angles. Inner cells of the sporangium wall with semiannular thickenings. Elater bearers 20-30, with 2-4 spirals, 15-25 μ thick, attached to the base of the sporangium and forming a bushy or columnar projection; elaters very long and narrow, contorted, about 225-400 μ long and 9-12 μ wide; their spirals mostly 2, yellow. Spores 84-105 x 51-61 μ, 4-5 cells long, 2-3 cells wide, oblong-oval, yellowish green, muriculate. Named in honor of C. G. Nees von Esenbeck, 1776-1858, Professor of Botany in Breslau, Germany.—On wet or springy ground.

ILLUSTRATIONS: K. Mueller (409) 1: fig. 218, II; Sanborn, Univ. of Oregon Pub., Pl. Biol. Ser. 1: pl. 1, figs. 5-6, 1929; Meylan (386) figs. 50 and 51; Macvicar (374) 73, figs. 1-3. EXAMINATIONS:—*N. C.* Winston-Salem (Chapman) 1922.—*Mont.* Glacier Nat. Park (Frye) 1929.—*Ida.* Cascade (Rakestraw) 1934.—*Wash.* Ilwaco (Frye) 1904; Snoqualmie Pass (Frye) 1921; Mt. Rainier Nat. Park (Frye) 1923; Lapush (Frye) 1927.—*Ore.* Cape Arago (Frye) 1922.—*Cal.* Eureka (Frye) 1931.

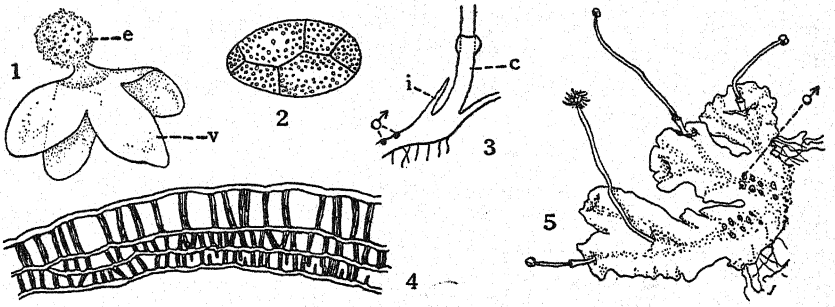
TYPE LOCALITY: European. RANGE: Cape Breton Isl. (413), N. S. (413), Me. (363), N. H. (159), Vt. (241), Mass. (191), Conn. (156), N. Y. (59), Que. (178), Pa. (338), Mich. (415), Wis. (94), Mont. (81), Alta. (51), Alaska (373), B. C. (371), Ida. (81), Wash. (81), Ore. (239), Cal. (292), N. C. (43), Ky. (218); Asia (226); Eur. (329).

3. Pellia epiphylla[142] (L.) Corda, Opiz, Beitr. 654, 1829.

Jungermannia epiphylla L. Sp. Pl., Ed. 1, 1135, 1753.
Scopulina epiphylla Dum. Comm. Bot. 115, 1822.
Blasia epiphylla Fries Stirp. Fremson. 31, 1825.
Gymnomitrion epiphyllon Hueben. Hep. Germ. 42, 1834.
Marsilia epiphylla Lindb. Musc. Scand. 10, 1879.

Thalli prostrate, forming mats, dark green, sometimes tinged with purplish red; branches few and dichotomous, 1-7 cm long, 10-15 mm wide, cordate at tip, firm, not collapsing. Vein wide, convex on under side, gradually thinning toward margin. Rhizoids numerous, brownish. Cross section 11-15 cells thick in the middle; cells with numerous oil bodies, some near middle with thick violet red vertical interlacing thickenings in the walls; in median longitudinal section these mostly as vertical band-like thickenings in the cells. Thalli bisexual. Antheridia directly behind the archegonia, the papilla over each antheridial cavity visible to the naked

eye usually as a red point. Involucre in the form of a scale-like flap on the posterior side of the pocket-like cavity from which the calyptra arises incised at the free margin. Calyptra arcuate, tubular-clavate, wider above, partly rose red, very large, emerging perhaps half its length from the involucre, roughened with scattered 2-celled hairs. Seta hyaline, up to 5 cm long. Sporangium globose, dark olive green, its wall composed of 2-3



Pellia epiphylla. 1, Sporangium open, with reflexed valves, (*v*) valve, (*e*) elater bearers, x 7. 2, Multicellular spore, x about 200. 3, Diagram of longitudinal section through (*i*) involucre, (*c*) calyptra. 4, Cross section of wall of sporangium showing thickenings in the cells, x 227. 5, Plant x 0.7. (1, after Pearson; 5, after Schiffner; the others after K. Mueller.)

layers of cells. Epidermal cells of the sporangium wall larger than the others, hexagonal, with nodular thickenings. Inner layer of cells of the sporangium wall elongate, with numerous semiannular thickenings. Elater bearers 20-30, 2-4-spiral, 15-25 μ thick, attached to the base of the sporangium and forming a bushy or columnar projection; elaters very long and narrow, contorted, about 8 μ wide and 500 μ long, their spirals mostly 2, yellow. Spores about 75 x 100 μ, oblong-oval, yellowish green, muriculate. Gk. *epi,* upon, and *phyllon,* leaf; referring to the conspicuous sporophyte growing out of the upper side of a leaf-like gametophyte. —On wet ground in springy places, or on moist ground in shade.

ILLUSTRATIONS: Hooker, Brit. Jung. pl. 47, 1816; Schiffner (458) figs. 27, 32; Ekart, Syn. Jung. Germ. pl. 7, fig. 52, and pl. 13, fig. 111, 1832; Sullivant, Mosses of the U. S., pl. 7, 1856; Underwood, Gray's Manual of Botany, Ed. 6, pl. 23, 1889; Jack, Flora 81: pl. 1, figs. 1-6, 1895; Pearson (433) pl. 97; Warnstorf (523) 106, figs. 3a-3d; K. Mueller (409) 1: fig. 217; Greenwood, Bryologist 14: pls. 7-15, 1911; Macvicar (374) 72, figs. 1-5. EXAMINATIONS:—*N. C.* Winston-Salem (Schallert) 1923.—*Wyo.* Yellowstone Nat. Park (Frye) 1934.—*Mont.* Rock Creek in Carbon County (Porter 1654) 1934.—*Wash.* Orcas Island (Clark) 1923; Stevens Pass (Rakestraw) 1934.—*Ore.* Halfway (Rakestraw) 1935; Lick Creek in Wallowa Mts. (Rakestraw) 1935.

TYPE LOCALITY: European. RANGE: Labrador (510), Miquelon Isl. (431), Prince Edward Isl. (373), Cape Breton Isl. (47), N. S. (413), N. B. (369), Me. (366), N. H. (140), Vt. (169), Mass. (232), R. I. (140), Conn. (467), N. Y. (58), Que. (178), Pa. (237), Mich. (415), Ind. (212), Wis. (98), Wyo., Mont., Alaska (135), B. C. (508), Wash. (81), Ore. (239), Tex. (338), Tenn. (12), Ga. (12), N. C. (243), Ky. (218), W. Va. (466), Va. (127), Md. (444), D. C. (345), Neb. (350); Eur. (329).

METZGERIA[143] Raddi, Mem. Soc. Ital. Sci. Modena 18:45, 1818.

Jungermannia L. Sp. Pl., Ed. 1, 1136, 1753, in part.
Rhizophyllum Beauv. Fl. d'Ow. Ben. 1:21, 1804, in part.
Papa S. F. Gray Nat. Arr. Brit. Pl. 1:679, 1821.
Hervera S. F. Gray Nat. Arr. Brit. Pl. 1:685, 1821.
Fasciola Dum. Comm. Bot. 114, 1822.
Echinogyna Dum. Sylloge Jung. Eur. 83, 1831.
Echinomitrium Corda, Sturm Deutschl. Fl. 2:77, 1832.

Thalli prostrate, light green, linear, usually dichotomously branched and very often also with ventral branches from the side of the vein, hairy or rhizoidous beneath or on top or both. Vein sharply defined, slender, bulging on both surfaces, commonly of few large epidermal cells and smaller interior cells. Lamina of 1 layer of cells. Gemmae marginal, or dorsal on the lamina, or from the vein of a specialized branch, from a single epidermal cell, multicellular, sometimes developing into thalli before becoming disconnected. Thalli unisexual or bisexual. Reproductive branches ventral, circinately revolute into a ball-like form, much smaller than normal branches. Sex organs on the inner (dorsal) side. Male branches not hairy outside, with distinct vein; antheridia along both sides of the vein, in acropetal succession. Female branches hairy outside without vein in most species, forming a somewhat fig-shaped involucre. Calyptra obpyriform or claviform, hairy; its hairs numerous, divaricate. Pseudoperianth wanting. Seta short. Sporangium oval to oblong, 4-valved to base, its wall of 2 layers of cells. Valves broadly ovate, sharply pointed; epidermal cells of the sporangium with nodular thickenings; inner cells of the wall with faint semiannular thickenings. Elaters as large in diameter as the spores, long, attenuate; spiral 1, wide, reddish brown; elater bearers partly persistent as erect tufts on the apices of the valves. Spores finely papillose. Named in honor of Johannes Metzger, an engraver in the town of Staufen, south of Freiburg, in Baden, Germany, who was a friend of Raddi.

The sporophytes in *Metzgeria* are too uniform to serve as a criterion for subgeneric classification. The presence of a vein in the archegonial branch of *M. pubescens* and its absence in at least some other species may be a more basic distinction than differences in the purely vegetative parts, but the facts in this regard are insufficiently reported in too many species to make it practical at present. The hairiness of the sexual branches seems often to be related to the hairiness of the thallus. Thus the best characters upon which to base species at present seem to be (*a*) the vein, (*b*) the hairs or rhizoids[144] and (*c*) the location of the gemmae (Evans, 158).

A. Lamina not hairy on upper side, naked or hairy on the under side; upper side of vein 2-6 but nearly always 2 epidermal cells wide; antheridial branches naked or little hairy; archegonial branches veinless at least in many species.
B. Under side of vein 2 epidermal cells wide.
C. Lamina not hairy on the under surface, 12-20 cells wide from vein to margin.

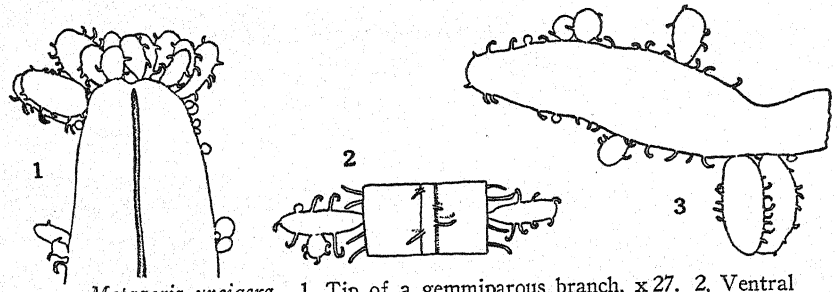
[143] Metz, Ger. t. a.
[144] Where to draw the line between hairs and rhizoids in this genus is not clear.

D. Marginal hairs single, usually straight but sometimes hooked; cells of the lamina averaging about 21x28 μ; antheridial branches with scattered marginal hairs.. 1. *M. uncigera.*
DD. Marginal hairs mostly paired, strongly falcate or hooked; cells of the lamina averaging about 37x51 μ; antheridial branches naked..... 2. *M. hamata.*
CC. Lamina hairy on the under surface, 5-8 cells wide from vein to margin; marginal hairs straight, mostly in pairs; archegonial branches with few hairs..... 3. *M. angusta.*
BB. Under side of vein 3-7 epidermal cells wide.
E. All of the marginal hairs of the thallus single; antheridial and archegonial branches with few hairs.
F. Gemmae on the dorsal surface of the lamina of a normal branch; cells of the lamina averaging less than 35 μ; marginal hairs not displaced to the under side. 4. *M. crassipilis.*
FF. Gemmae marginal or on the vein on both sides; cells of the lamina averaging 35-42 μ; marginal hairs displaced to the under side.
G. Gemmae on the margin of a hardly modified branch; plant green when dry..... 5. *M. furcata.*
GG. Gemmae on the margin as well as on the upper and under sides of a more or less ascending branch so narrow that little or no lamina remains; plant bluish when dry..... 5a. Var. *fruticulosa.*
EE. Most of the marginal hairs in groups of 2 or more; at least the archegonial branch quite hairy.
H. Most of the marginal hairs of the thallus in pairs; this is our only species with bisexual thalli; thalli about 2 mm wide; cells of the lamina about 45x60 μ..... 6. *M. conjugata.*
HH. Most of the marginal hairs of the thallus in groups of 3-6; thalli unisexual; thalli about 1 mm wide; cells of the lamina about 40 μ..... 7. *M. ciliifera.*
AA. Lamina hairy on both sides; vein 8-12 epidermal cells wide on both sides; antheridial branches densely hairy; archegonial branches with a vein..... 8. *M. pubescens.*

1. **Metzgeria uncigera**[145] Evans, Ann. Bot. 24:276, figs. 1-3, 1910.

Thalli pale green, growing in depressed mats, prostrate, subsimple to repeatedly dichotomous, up to 5 cm long, plane; well developed branches about 1.2 mm wide, 1.5-2.5 mm long between two successive forks. Lamina usually 15-20 cells wide; its cells thin walled throughout, averaging about 21 x 28 μ, not varying much in size in the different parts of the thallus. Epidermal cells of the vein in two rows on both sides. Rhizoids or hairs few, on the margin and on the under side of the vein; marginal hairs averaging about 70 μ long, usually straight, sometimes hooked at tip, occurring singly, often slightly displaced to the under side, sometimes truly marginal. Gemmae marginal, ligulate, 1 cell thick throughout, without a distinct stalk; apical cell 1, terminal; the hairs of the margins slightly displaced to one of the surfaces, hooked at tip. Thalli unisexual. Male branches broadly orbicular-obovate, about 150 μ long, with scattered marginal hairs. Otherwise unknown. L. *uncus,* a hook, and *gerere,* to bear; in reference to the hooked marginal hairs.—On trunks of trees.

[145] ŭn sĭ' ĝĕr ă.



Metzgeria uncigera. 1, Tip of a gemmiparous branch, x 27. 2, Ventral view of a part of a thallus, x 24. 3, Apical portion of a gemmiparous thallus grown from a gemma, x 27. (1, 3, after Evans; 2, after Kurz & Little.)

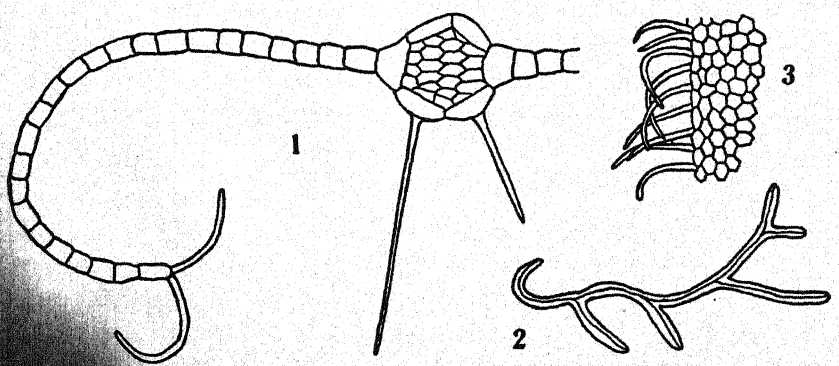
ILLUSTRATIONS: Evans, Ann. Bot. 24:274-276, figs. 1-3, 1910, (gemmae only); Kurz & Little, Bull. Florida State College for Women (Tallahassee) 26 (3):27, fig. 7, 1933. EXAMINATIONS:—*Fla.* Oviedo (Rapp 19), undated.

TYPE LOCALITY: Mount Morales near Utuado, Porto Rico (Howe 1128) March 19, 1906. RANGE: *Fla.* (337); Porto Rico (172).

2. Metzgeria hamata[146] **Lindb. Monog. Metzg. 25, 1877.**

Jungermannia furcata var. *elongata* Hook. Brit. Jung. pls. 55, 56, 1816.
M. furcata var. *extensa* Nees Naturg. Eur. Leberm. 3:485, 1838.
M. linearis of Lindb., Soc. Sci. Fauna et Fl. Fennica 10:494, 1875. Not of Aust., Bull. Torr. Bot. Club 6:18, 1875. Not of Migula, Deutschen Krypt.-Fl. 1:422, (according to K. Mueller). Not *Jungermannia linearis* Sw. Prodr. Fl. Ind. 145, 1797.

Thalli pale green to yellowish green or bright green, only slightly shiny, elongate, convex on upper side, rather irregularly dichotomously branched, 2-10 cm long, 1.5-2.5 mm wide, or when flattened out up to 3 mm wide. Vein almost equally convex on the two surfaces; interior cells thin walled, 15-20 μ, in 4-5 layers with odd cells under middle of the epi-



Metzgeria hamata. 1, Part of cross section of thallus, x 80. 2, Thallus, x 1. 3, Part of margin of thallus, x 60. (1, after K. Mueller; 2, 3, after Pearson.)

dermis. Lamina naked, 12-20 cells wide; its cells regularly hexagonal, thin walled, 30-50 x 40-65 μ, the walls slightly thickened at the angles. Epidermal cells of the vein in 2 rows on both sides. Margins revolute, sometimes even meeting beneath. Rhizoids or hairs wanting on upper surface, numerous along margin and under side of vein; those of the vein in 2 rows, long, incurved or hooked; those of the margin paired or a few ternate, divaricate, strongly falcate to hooked. Gemmae marginal, often growing into thalli while still attached and thus appearing to be marginal branches. Thalli unisexual. Male branches without hairs, containing 4-8 antheridia. Female branches round-ovate, without a vein; margin hairy; hairs single, many, long, straight. L. *hamatus,* hooked; in reference to the hooked marginal rhizoids or hairs.—On trees, moss, ground or rocks.

ILLUSTRATIONS: Lindberg, Monog. Metzg. 7: fig. 5, 1877; Pearson (433) pl. 207, figs. 7-9; K. Mueller (409) 1: fig. 210; Macvicar (374) 62, figs. 1-3. EXAMINATIONS:—*N. C.* Grandfather Mt. (Schallert) 1923.

TYPE LOCALITY: Ireland. RANGE:[147] N. C. (43), Tenn. (464); Alaska (135); W. Indies (458); Mex. (224); S. Amer. (433); N. Z. (348); Polynesia (409); Papua (491); Java (491); Asia (173); Eur. (409); Africa (348).

3. **Metzgeria angusta**[148] Steph., Bull. Herb. Boissier 7:944, 1899, also Sp. Hep. 1:292, 1899.

Thalli delicate, whitish to yellowish or reddish green, repeatedly furcate, up to 3 cm long, more or less convex on upper side. Vein narrow. Lamina naked above, up to 8 cells wide on each side of the vein, sparsely hairy beneath but sometimes naked; its cells papillose about 37 x 54 μ, rather distinctly thickened in the angles. Epidermal cells of the vein in 2 rows on each surface. Margin hairy. Rhizoids or hairs on margins, also on under side of lamina and of vein; those of margin in pairs, short, divergent, like those on the lamina. Gemmae apparently not observed. Thalli unisexual. Male branches few, naked. Female branches with long bristles. Calyptra long setose. L. *angustus,* narrow; in reference to its thallus.—On ground and trees.

ILLUSTRATIONS: None. EXAMINATIONS: None.

TYPE LOCALITY: South America. RANGE:[149] La. (491);[150] Mex. (491); West Indies (491); S. Amer. (491).

[147]We feel some doubt about all the reports of its occurrence within our territory, for the reason that the material collected in our area needs comparative study especially in regard to the formation of the gemmae.

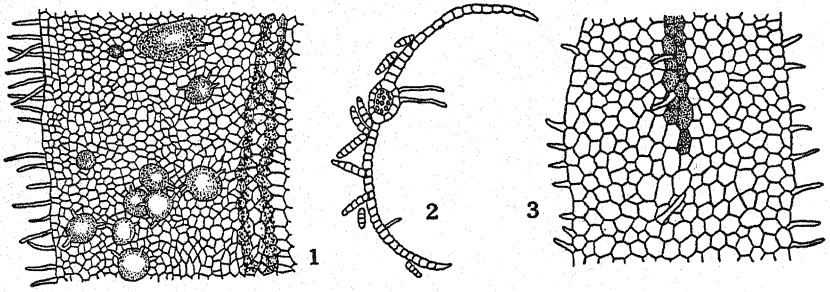
[148]ăn ğŭs' tă.

[149]Stephani speaks of the German plants being smaller (491) but gives no European locality. This suggests an error.

[150]Its occurrence within our territory rests upon this report of its collection by Lindberg. We have not seen the plant.

4. **Metzgeria crassipilis**[151] Lindb. Monog. Metzg. 42, 1877.

Thalli as in *M. furcata* in form and branching but larger, branching from the vein beneath, pale, slightly pellucid, upper side distinctly convex; vein 2 epidermal cells wide on the upper side, or of the gemmiferous branches 2-4; rhizoids or hairs all single, stiff, long, numerous, on under side of vein and lamina and also on the margin; those on the under side of the vein slightly and irregularly curved; those of the margin not dis-



Metzgeria crassipilis. 1, Portion of a gemmiparous thallus, x 33. 2, Cross section of gemmiparous branch, x 33. 3, Portion of thallus grown from gemma and showing beginnings of vein, x 53. (All after Evans.)

placed to the under side of the margin, divaricate, more or less extending in the plane of the thallus or curved toward the upper side. Laminal cells averaging less than 35 μ, with few chloroplasts. Gemmae on the lamina, on the upper side of slightly modified branches, numerous, discoid, circular, 1 cell thick, 6-8 cells in diameter. Thalli unisexual. Male branches naked. Female branches naked when quite young; in maturity sparingly hairy along the margin, occasionally with a few short hairs on the outer (under) side. Involucre smooth. Calyptra and sporophyte unknown. Name from L. *crassus,* thick, and *pilum,* hair; probably in reference to the rather thick-walled hairs.—On wet rocks; on bark of trees.

ILLUSTRATIONS: Evans, Ann. Bot. 24:282-284, figs. 8-10, 1910, (gemmae). EXAMINATIONS:—*N. C.* Winston-Salem (Schallert) 1923.

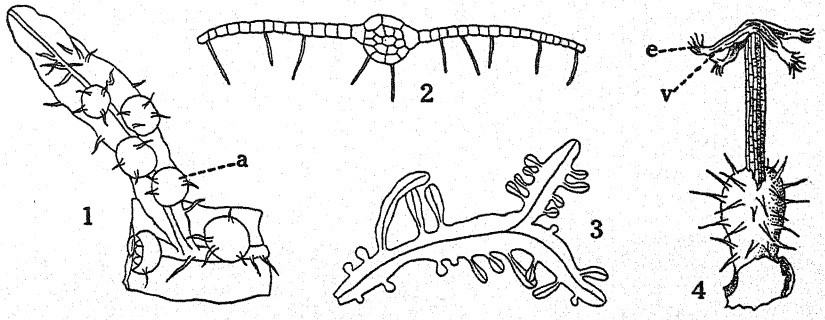
TYPE LOCALITY: Laurel Hill, Pennsylvania (W. S. Sullivant) June 23, 1843. RANGE: N. S. (53), Vt. (158), N. Y. (156), Pa. (156), W. Va. (468), Ky. (218), Tenn. (464), N. C. (10), Va. (271), Mass. (159), Conn. (203).

[151] Words of pl ills.

5. **Metzgeria furcata**[152] (L.) Dum. Rec. d'Obs. 26, 1835.

Jungermannia furcata L. Sp. Pl., Ed. 1, 1136, 1753, in part.
M. glabra Raddi, Mem. Soc. Ital. Sci. Modena 18:45, 1818.
Hervera furcata S. F. Gray Nat. Arr. Brit. Pl. 1:685, 1821.
Fasciola furcata Dum. Comm. Bot. 114, 1822.
Blasia furcata Fr., Phys. Saellsk. Arsb. 1:99, 1823.
Echinogyna furcata Dum. Syll. Jung. 83, 1831.
Echinomitrion furcatum Corda, Sturm Deutschl. Fl. 2:78, 1832.
M. planiuscula Spruce, Revue Bryol. 15:34-35, 1888.
M. flavovirens Colenso, Trans. N. Zealand Instit. 21: 1889.

Thalli green to yellowish green, somewhat shiny, plane or slightly convex on upper side, dichotomously branched and commonly forked at tip, 5-25 mm long, 0.3-1 mm wide. Vein slightly convex on upper side, decidedly so on lower side, its upper epidermis of 2 rows of cells, its low-



Metzgeria furcata. 1, Ventral view of part of male plant, (*a*) antheridial branch, x about 15. 2, Cross section of thallus, x 45. 3, Plant with gemmae in various stages, x 10. 4, Sporophyte projecting from female branch, (*v*) valve, (*e*) elater bearers, x about 15. (1, 4, after Pearson; 2, 3, after K. Mueller.)

er usually of 4 rows each about 25 μ in width; its interior cells about 15 μ wide, in 3 layers. Laminal cells hexagonal, thin walled, 35-50 μ, their walls very little thickened in the angles. Rhizoids or hairs wanting on upper side, sparingly present on under side of vein and lamina, also on margin, straight or flexuose, some branched at tip, those of the margin single. Gemmae marginal, of several to many cells, very soon forming a vein and dorsal slime papillae. Thalli unisexual. Male branches naked. Female branches hairy. Calyptra fig-shaped, with rather numerous but not bristly hairs. Seta 1-2.5 mm long. Sporangium ovoid-globose, reddish brown. Elaters whip-like in form, 5-7 μ wide; spiral 1, reddish brown, 4-6 μ wide. Spores 20-28 μ, granular-papillate and thus apparently finely punctate, greenish yellow to brownish yellow. L. *furca,* a fork, in reference to the commonly forked tips of the thallus.—On trees and rocks, usually in rather dry places.

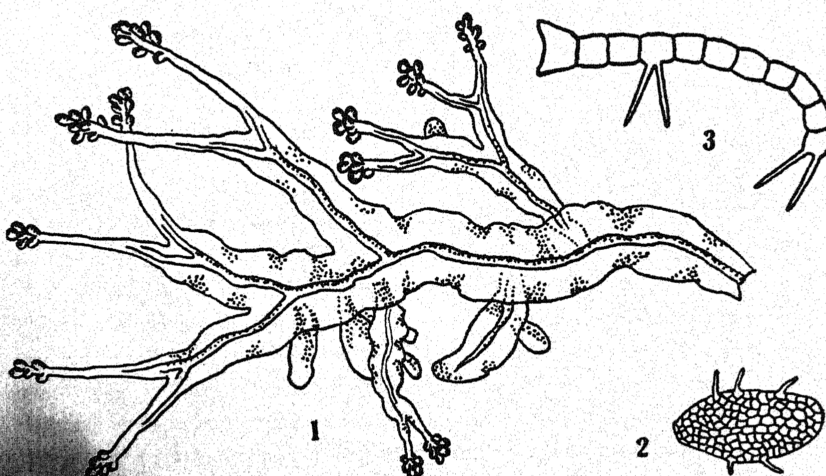
[152]für kā' tä.

ILLUSTRATIONS: Hooker, Brit. Jung. pl. 56, 1816; Pearson (433) pl. 206; Warnstorf (523) 106, figs. 2b-2d; Evans, Ann. Bot. 24:277, fig. 4, 1910, gemma; Lindberg, Monog. Metzg. fig. 8, 1877; K. Mueller (409) 1: figs. 86, 207; Macvicar (374) 59, figs. 1-3; Meylan (386) figs. 46a-46b. EXAMINATIONS:—*N. S.* Indian Brook (Nichols) 1909.—*Me.* Farmington (Parlin) 1929.—*Vt.* Woodstock (Dutton 425) 1912.—*Que.* Mt. St. Helaire (Victorin 29, 30) 1910.—*N. Y.* West Fort Ann (Burnham 104) 1918.—*Pa.* Bethlehem (Rau 30) undated.—*Ohio.* Ash Cave (Taylor) 1925.—*N. C.* Winston-Salem (Schallert) 1921.—*W. Va.* Anderson (Gray) 1922; Wardenville (Ammons 209) 1930.—*Md.* Cabin John (Sribla) undated.—*Conn.* Woodbridge (Evans) 1910.

TYPE LOCALITY: European. RANGE: Cape Breton Isl. (156), N. S. (53), Me. (156), N. H. (511), Vt. (245), Conn. (169), N. Y. (59), Que. (49), Pa. (511), Mich. (483), Ohio, Ky. (218), Tenn. (268), N. C. (43), W. Va., Md.; W. Indies (478); S. Amer. (230); N. Z. (409); Australia (409); Asia (409); Eur. (312).

5a. **Metzgeria furcata var. fruticulosa**[153] (Dicks.) Lindb. Monog. Metzg. 40, 1877.

Riccia fruticulosa Dicks. Pl. Crypt. Brit. Fasc. 1:8, 1785.
Jungermannia fruticulosa Sm. Engl. Bot. 35: pl. 2514, 1813.
Jungermannia furcata var. *aeruginosa* Hook. Brit. Jung. pl. 55-56, 1816.
Hervera furcata var. *aeruginosa* S. F. Gray Nat. Arr. Brit. Pl. 1:685, 1821.
Fasciola violacea Dum. Comm. Bot. 114, 1822; not *Jungermannia violacea* Ach., Web. & Mohr Beitr. 1:76, 1805.
Echinogyna violacea Dum. Syll. Jung. Eur. 84, 1831.
Echinomitrion violaceum Corda, Sturm Deutschl. Fl. 2:81, pl. 22, 1832.
Echinomitrium furcatum var. *violaceum* Hueben. Hep. Germ. 47, 1834.
M. violacea Dum. Rec. d'Obs. 1:26, 1835.
M. furcata var. *gemmifera* Nees Naturg. Eur. Leberm. 3:488, 1838.
M. furcata var. *violacea* Nees Naturg. Eur. Leberm. 3:489, 1838.
M. furcata var. *prolifera* Nees Naturg. Eur. Leberm. 3:489, 1838.
M. fruticulosa (Dicks.) Evans, Ann. Bot. 24:293, 1910.
M. furcata var. *pacifica* Brinkman, Bryologist 34:15, 1931.



Metzgeria furcata var. *fruticulosa.* 1, Plant with gemmiparous tips, x about 10. 2, Gemma, x about 13. 3, Cross section of part of thallus, x 140. (1, 2, after Hooker; 3, after Meylan.)

[153] frū tĭk' ū lō' să.

Thalli yellowish green but often becoming bluish green when dry, more forked toward the tips than in the type; some branches suberect, more elongate than the type and narrower, strongly convex above, with discoid or oblong gemmae from the margin and from both surfaces near the apex. Vein narrow toward base of thallus and usually of few cells, of the branches wider and of many cells; epidermal cells of the vein in 2 rows on each surface, or more on the gemmiferous branches; interior cells about 10 in cross section. Rhizoids or hairs numerous, straight, sometimes divided at tip and evidently rhizoids, most of the marginal hairs single but some in pairs. Gemmiparous branches specialized, suberect to erect, more elongate, narrower, sometimes without lamina in parts; gemmae multicellular, discoid or oblong, from the margin, or from the vein on any side where the lamina is not present, obovate and about 120 μ wide when mature. L. *fruticulosus,* like a small shrub; in reference to its branching.—On the bark of alder trees in very moist places.

ILLUSTRATIONS: Smith, Eng. Bot. 35: pl. 2514, 1813; Hooker, Brit. Jung. pl. 55, 1816; Evans, Ann. Bot. 24:294, fig. 16, 1910; Meylan (386) figs. 46c and 46e. EXAMINATIONS:—*Wash.* Clearwater (Frye) 1931.

TYPE LOCALITY: British Isles. RANGE: B. C. (49), Wash. (162), Ore. (364); Mex. (224); Eur. (374).

The occurrence in Mexico is questionable, since the locality is so isolated from the others. The report, however, is old (1863) and may be due to wrong determination. Nearly all the species of *Metzgeria* have many points in their structure yet uncertain.

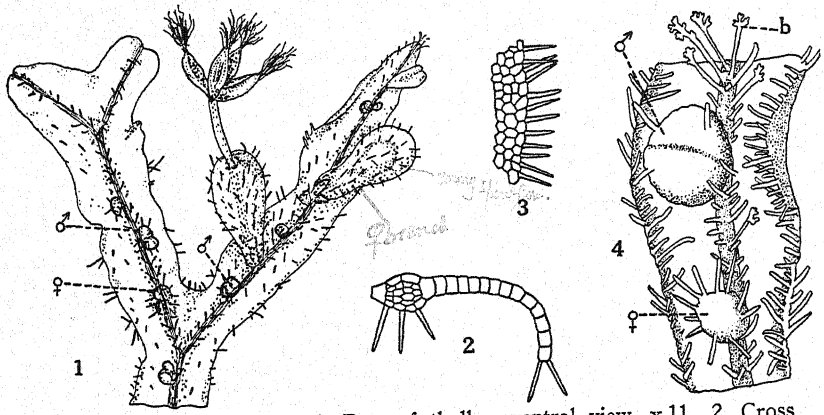
6. Metzgeria conjugata[154] **Lindb., Soc. Sci. Fennica 10:495, 1875.**

Jungermannia furcata of Weiss. Pl. Crypt. Fl. Gott. 108, 1770; not of L. Sp. Pl. Ed. 1, 1136, 1753.
Jungermannia furcata var. *maxima* Web. Spic. Fl. Goett. 160, 1778.
Hervera furcata S. F. Gray Nat. Arr. Br. Pl. 1:85, 1821.
Fasciola furcata Dum. Comm. Bot. 114, 1822.
Jungermannia furcata var. *epigaea* Wallr. Fl. Crypt. Germ. 1:49, 1831.
Echinogyna furcata Dum. Syll. Jung. Eur. 83, 1831.
Echinomitrium furcatum var. *B* Corda, Sturm Deutschl. Fl. 2:78, 1832.

Thalli green to yellowish green, but little shining, somewhat translucent, convex on upper side, regularly dichotomously branched, the branches linear, 2-3 cm long, 2 mm wide. Vein convex on both surfaces, more so on the lower; interior cells smaller than those of the lamina, about 25 μ, in 4 layers. Lamina naked or rarely with a few scattered hairs on under side; its cells hexagonal, 45 x 60 μ, with walls very slightly thickened in the angles. Epidermal cells of the vein in 2 rows on the upper side, in 3-5 (usually 4) on the lower, the lower not greatly larger than the interior cells, the upper large. Margin curved down but not revolute. Rhizoids or hairs on margin and under side of the vein, sometimes a few

[154] kŏn jū gā' tă.

on under side of the lamina, frequently ending in somewhat palmately branched short tips; those on the margin mostly in pairs, divaricate, straight, rather numerous and stiff, those on the vein also numerous. Gemmae marginal. Thalli bisexual. Male branches near the female ones,



Metzgeria conjugata. 1, Part of thallus, ventral view, x 11. 2, Cross section of part of thallus, x 40. 3, Portion of margin of thallus, x 40. 4, Portion of thallus in ventral view showing both kinds of rolled up sexual branches, (*b*) branched rhizoids, x 40. (1, after Schiffner; 4, after K. Mueller; 2, 3, after Pearson.)

often almost in contact with them, with some hairs on the outer (under) side. Female branches with numerous hairs on the outer (under) side. Calyptra with numerous bristle-like hairs. Seta about 1.4 mm long. Elaters with 1 dark red spiral. Spores 18-23 μ, brownish yellow. L. *conjugatus,* to couple or pair; in reference to the close proximity of the male and female branches.—In shade, on rocks and trunks of trees.

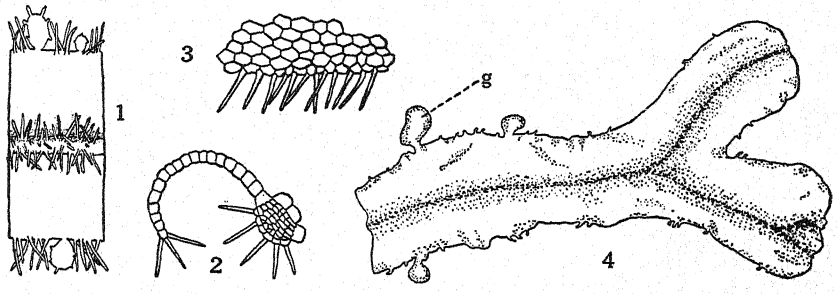
ILLUSTRATIONS: Hooker, Brit. Jung. pl. 56, fig. 2, 1816; Ekart, Syn. Jung. Germ. pl. 1, fig. 1, 1832; Lindberg. Monog. Metzg. fig. 6, 1877; Pearson (433) pl. 207; K. Mueller (409) 1: fig. 209; Macvicar (374) 61, figs. 1-3; Schiffner (458) fig. 30; Meylan (386) figs. 44, 46d and 47. EXAMINATIONS:—*N. C.* Moore's Springs (Schallert) 1923.—*Alaska.* Juneau (A. Mehner) 1904.—*Wash.* Friday Harbor (Clark) 1923; Darrington (Frye) 1928; Kelso (Rakestraw) 1934.—*Ore.* Wedderburn (Rakestraw) 1936.—*Cal.* Smith River (Rakestraw) 1936.

TYPE LOCALITY: European. RANGE: Me. (140), N. H. (359), Vt. (140), Mass. (5), R. I. (169), Conn. (212), N. Y. (58), Pa. (338), Ont. (373), Wis. (98), Alaska (173), B. C. (49), Wash. (81), Ore. (457), Cal. (504), N. Mex. (272), La. (396), Ala. (396), Fla. (396), N. C. (243), Tenn. (464), Ky. (218), W. Va. (466), Va. (271), Md. (444), D. C. (282); Bermuda (146); S. Amer. (212); N. Z. (491); Celebes (491); Java (491); Asia (433); Eur. (348); Africa (212); Madagascar (491).

7. **Metzgeria ciliifera**[155] Schweinitz Musc. Hep. Amer. Sept. 20, 1821.

M. myriopoda Lindb. Monog. Metzg. 22, fig. 5, 1877.

Thalli long, linear, of almost uniform width, convex on upper side, simple or usually somewhat dichotomously branched, 5 cm long, 1 mm wide. Vein densely setose-pilose beneath; its interior cells smaller toward the upper side. Lamina naked; its cells about 40 μ, without trigones. Margins reflexed, not undulate. Epidermal cells of the vein in 2 rows on the upper side, in 3-7 but usually 4-6 on the under side; the cells of the



Metzgeria ciliifera. 1, Ventral view of a part of a plant, x 23. 2, Cross section of part of thallus, x 40. 3, Portion of margin of thallus, x 40. 4, Thallus, (*g*) gemma, x 11. (1, 4, after Kurz & Little; 2, 3, after Lindberg.)

under side of the vein smaller, lax, often indistinct. Rhizoids or hairs rather long, straight or nodding, some of them with palmately branched sucker-like tips, the marginal ones in tufts of 3-6 or rarely single or paired. Gemmae marginal, about 6 cells wide, 1 cell thick throughout or almost so, up to 1.5 mm long before separation. Thalli unisexual. Female branches densely hairy along the margin. Calyptra clavate, long hairy. Mature fruit apparently unknown. Name from L. *cilium,* eyelash, and *ferere,* to bear; apparently in reference to the many tufted marginal cilia-like rhizoids or hairs.—On shaded rocks and trees.

ILLUSTRATIONS: Lindberg, Monog. Metzg. fig. 5, 1877; Evans, Ann. Bot. 24:279, fig. 6, 1910 (gemmae); Kurz & Little, Bull. Fla. State College for Women 26 (3):27, figs. 9, 11, 1933. EXAMINATIONS:—*Fla.* Sanford (Rapp) 1917.

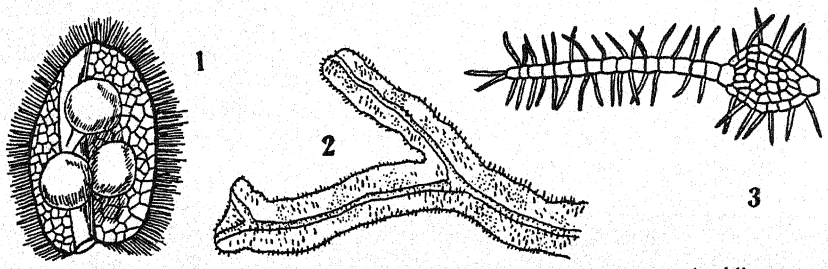
TYPE LOCALITY: Alleghany Mts. (Sullivant and A. Gray) 1843. RANGE: Que. (178), D. C. (444), N. C. (43), Tenn. (348), Ga. (52), Fla. (266), La. (504); S. Amer. (158).

[155] sĭ lĭ ĭ' fĕr ă.

8. **Metzgeria pubescens**[156] (Schrank) Raddi, Mem. Soc. Ital. Sci. Modena 18:46, 1818.

Jungermannia pubescens Schrank Prim. Fl. Salisb. 231, 1792.
Jungermannia tomentosa Hoffm. Deutschl. Fl. Krypt. 2:91, 1795.
Hervera pubescens S. F. Gray Nat. Arr. Brit. Pl. 1:685, 1821.
Fasciola pubescens Dum. Comm. Bot. 114, 1822.
Echinogyna pubescens Dumm. Syll. Jung. Eur. 84, 1831.
Echinomitrium furcatum var. *pubescens* Corda, Sturm Fl. Germ. 2:78, 1832.
Echinomitrium pubescens Hueben. Hep. Germ. 48, 1834.

Thalli grayish green or yellowish green, not shiny, not convex on upper side, irregularly pinnate, with the branches frequently very gradually attentuate to an obtuse apex, 2-3 cm long, 1-2 mm wide. Vein subterete, quite convex on both sides, 8-12 epidermal cells wide on each side; the epidermal cells inconspicuous, hardly larger than the interior cells, in



Metzgeria pubescens. 1, Antheridial branch, with three antheridia, x about 60. 2, Plant, x about 6. 3, Part of cross section of thallus, x 60. (1, 2, after Hooker; 3, after Lindberg.)

4-7 layers, all about 25 μ. Laminal cells 5-6-angled, not elongate, 32-42 μ, thin walled, hardly thickened at the angles. Rhizoids or hairs very numerous, on the margin and on both surfaces of the vein and of the lamina, pointed, straight or slightly bent, about 90 μ long, marginal ones frequently 2-3 in a group. Thalli unisexual. Male branches with rhizoids or hairs only on the under (outer) side, with vein. Female branches with rhizoids or hairs on both sides, with vein. No one seems to have seen the mature sporangia. L. *pubescens,* hairy; from the hairy thalli.—On rocks and trunks of trees.

ILLUSTRATIONS: Hooker, Brit. Jung. pl. 73, 1816; Ekart, Syn. Jung. Germ. pl. 3, fig. 19, 1832; Lindberg, Monog. Metzg. fig. 1, 1877; Pearson (233) pl. 205; K. Mueller (409) 1: figs. 3, 211; Macvicar (230) 63, figs. 1-3. EXAMINATIONS:—*Alaska.* Juneau (Mehner) 1904.—*Mont.* Polson (Frye) 1928; Glacier Nat. Park (Frye) 1934. —*Wash.* Spieden Island (Clark) 1925; Snoqualmie (Frye) 1930; Mt. Rainier Nat. Park (Frye) 1934.—*Ore.* Clear Lake (Rakestraw) 1936.

TYPE LOCALITY: European. RANGE: Me. (171), N. H. (359), Vt. (164), D. C. (343), Yukon (298), Alaska (100), B. C. (390), Mont. (81), Ida. (508), Wash. (81), Ore.; Asia (348); Eur. (119).

[156] Pro. Lec. Hep.

MOERCKIA[157] Gottsche, Gottsche & Rabenhorst Hep. Eur. Exsic. No. 121, 1860.

Jungermannia Hook. Brit. Jung. pl. 78 and Suppl. pl. 4, 1816.
Pallavicinius S. F. Gray Nat. Arr. Brit. Pl. 1:775, 1821.
Dilaena Dum. Comm. Bot. 114, 1822.
Diplomitrion Corda, Opiz, Beitr. 1:653, 1829.
Diplolaena Dum. Syll. Jung. 82, 1831.
Cordaea Nees, Diar. Bot. Ratisb. 2:401, 1833.
Gymnomitrion Hueben. Hep. Germ. 44, 1834.
Calycularia Mitt., Proc. Linn. Soc. 5:122, 1861.

Thalli prostrate, creeping, delicate or thick, forked at tip. Vein without a central strand, sometimes with 2 lateral strands, its inner cells thick walled. Lamina wide, its cells hexagonal. Epidermal cells of the costa narrow, elongate. Margin often undulate, never with leaf-like appendages. Ventral scales on each side of the vein, filamentous, composed of a single row of cells, evanescent. Thalli unisexual. Antheridia solitary or in pairs, usually in 2 rows on the dorsal side of the vein and toward the tip, covered by scales, the scales imbricate, oval, entire to laciniate, often united to form chambers. Sporophyte about the middle of the length of the thallus. Involucre of bracts; these bracts quite laciniate, coherent at base; pseudoperianth arising as a ring inside the involucre and ultimately greatly exceeding it, tubular and long, or pear-shaped. Calyptra tender above, shorter than the pseudoperianth, of 1 layer of cells. Seta 2-3 cm long. Sporangium cylindric-ovate; dehiscence by 2-4 valves; valves rarely coherent at apex; wall of sporangium 3-6 cells thick, without semiannular thickenings. Epidermal cells very large, brown, their walls firm. Inner layer of wall cells very small, all of them together only about as thick as the epidermis. Elater bearers wanting; elaters with 2 spirals, hardly contorted, not so very long, thin. Spores reticulate or papillose. Named in honor of A. Moerch, a worker on the flora of Denmark.

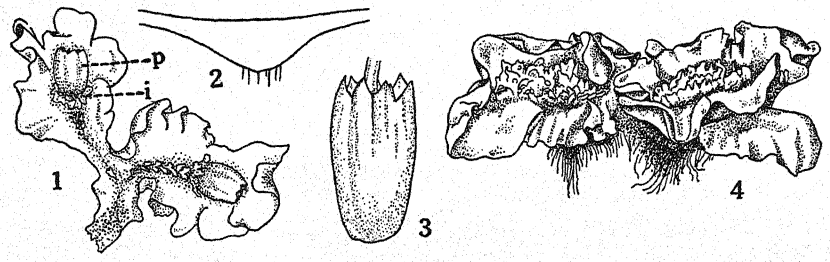
Upper side of vein with roundish or obovate scales, present on all plants; vein without a strand; rhizoids deeply yellow to reddish brown..... 1. *M. blyttii.*
Upper side of vein with roundish to ovate scales, present on male plants only; rhizoids hyaline or light yellowish.
  Vein without a strand; margin of thallus not or slightly undulate; vein 10-14 cells thick in middle; spores 35-43 μ..... 2. *M. hibernica.*
  Vein usually with a strand on each side of the middle; margin of thallus usually quite undulate; vein 15-20 cells thick in middle; spores 45-49 μ..... 3. *M. flotoviana.*

[157]mĕr' kĭ ä. We are following Macvicar, K. Mueller and other European authors in recognizing *Moerckia* as a genus. The chief characteristic upon which it rests is the 3-6-layered wall of the sporangium. This seems to us to be a distinct advance. With this goes the absence of a central strand in the vein of the thallus although sometimes 2 lateral strands are present. Thus the members can be easily recognized.

1. **Moerckia blyttii**[158] (Moerch) Brockman, Arch. Ver. Freunde Naturg. Mecklenburg 17:31, 1863.

Jungermannia blyttii Moerch, Fl. Danica 12:4, pl. 2004, 1830.
Gymnomitrion blyttii Hueben. Hep. Germ. 44, 1834.
Diplomitrium blyttii Corda, Sturm Deutschl. Fl. 2:126, 1835.
Cordaea blyttii Corda, Sturm Deutschl. Fl. 2:126, 1835.
Diplolaena blyttii Nees Naturg. Eur. Leberm. 3:339, 1838.
Thedenia blyttii Hartm. Skand. Fl., 1820-1843.
Blyttia moerckii Nees, G. L. & N. Syn. Hep. 474, 1844.
M. norvegica Gottsche, Gottsche & Rabenh. Hep. Eur. Exsic. No. 121, 1860.
Pallavicinia blyttii Lindb. En liten profbit pa namnfoerbistring, 1867. Helsingfors.
Dilaena blyttii Dum. Hep. Eur. 138, 1874.
Calycularia blyttii Steph. Sp. Hep. 1:360, 1900.

Thalli growing in patches, yellowish green or green, simple or forked, 1-2 cm long, 5-10 mm wide, 20-30 cells thick in the middle, gradually grading into the lamina; vein prominent on under side, with numerous plates along the upper side on sterile and fertile plants, without a strand



Moerckia blyttii. 1, Female plant, (*i*) involucre, (*p*) pseudoperianth, x 2.5. 2, Cross section of middle of thallus showing absence of strand, x about 15. 3, Pseudoperianth, x about 5. 4, Male plant, x 3.5. (1, 4, after K. Mueller; 3, after Pearson.)

within. Lamina 1 cell thick. Margin ascending, undulate, crisped. Rhizoids deeply yellow, or reddish brown, on the under side of the vein. Thalli unisexual. Antheridia near the tip; scales plicate, roundish to obovate, often 2-3-lobed, with 1 antheridium each. Female involucre of bracts; these coherent at base, short, wide, squarish, laciniately toothed at the end; pseudoperianth pear-shaped, up to 5 mm long, 2 cells thick above and 4-5 below, slightly plicate at apex; its mouth unequally lobed, with a few wide teeth, the lobes incurved. Calyptra thick below, shorter than the pseudoperianth. Seta 1-2 cm long. Sporangium oval-cylindric, 3-4 mm long, reddish brown, its wall of 5 layers of cells, with radial walls thickened and reddish. Epidermal cells of sporangium large. Inner wall cells of the sporangium much smaller and more delicate than the others. Spores 33-42 μ, reddish brown, with short curved irregular ridges and thus the margins appearing to have long flat teeth. Named in honor of

[158] blit' tl i.

N. N. Blytt, Professor of Botany in Oslo, Norway (1789-1862), who first discovered it.—On moist or wet ground at high altitudes.

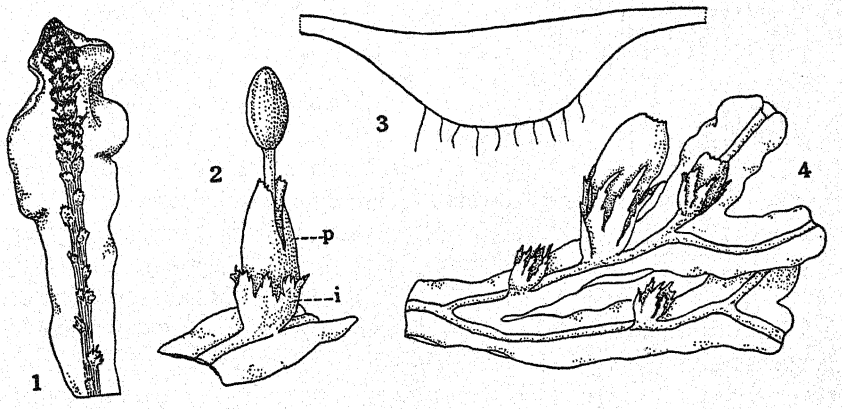
ILLUSTRATIONS: K. Mueller (409) 1: fig. 216; Pearson (433) pls. 194-195; Macvicar (230) 69, figs. 1-4. EXAMINATIONS:—*Wash.* Paradise Valley on Mt. Rainier (Flett) 1904; Humes Glacier in Olympic Mts. (Frye) 1907.

TYPE LOCALITY: Norway. RANGE: B. C. (157), Wash. (81); Eur. (329).

2. **Moerckia hibernica**[159] (Hook.) Gottsche Anmerkungen zu Gottsche & Rabenh. Hep. Eur. Exsic. No. 121, 1860.

Jungermannia hibernica Hook. Brit. Jung. pl. 78, and Suppl. pl. 4, 1816.
Pallavicinius hibernicus S. F. Gray, Nat. Arr. Brit. Pl. 684, 1821.
Dilaena hibernica Dum. Comm. Bot. 114, 1822.
Diplolaena hibernica Dum. Syll. Jung. 83, pl. 2, fig. 21, 1831.
Diplomitrion hibernicum Corda, Sturm Deutschl. Fl. 22:87, pl. 23, 1835.
Diplolaena lyellii var. *hibernica* Nees, Naturg. Eur. Leberm. 3:345, 1838.
Blyttia lyellia var. *hibernica* Nees, G. L. & N. Syn. Hep. 475, 1846.
Moerckia hibernica var. *hookeriana* Gottsche, Gottsche & Rabenh. Hep. Eur. Exsic. No. 121, 1860.
Pallavicinia flotowii var. *hibernica* Lindb. Musc. Scand. 10, 1879.
Calycularia hibernica Steph. Sp. Hep. 1:359, 1900.

Plants in pale green patches, thin, about 3.5 cm long, 2-4 mm wide, tender, forked; margin slightly to not at all undulate; vein triangular in cross section but rounded on ventral side, 8-14 cells thick, rather suddenly grading into the wing, without any strand. Rhizoids white, rather nu-



Moerckia hibernica. 1, Dorsal view of male plant with antheridia near tip, x 2.6. 2, Sporophyte, (*p*) pseudoperianth, (*i*) involucre, x about 3. 3, Cross section of thallus, x about 48. 4, Portion of female plant, x about 3. (1, after K. Mueller; 2, 4, after Hooker.)

merous, from under side of vein. Cells of the wing of the thallus 4-6-angled, elongate near the vein, thin walled. Thalli unisexual. Male plants smaller; antheridia in rows on the vein; antheridial scales ovate, dentate,

[159] hĭ bĕr' nĭ kă.

with 1-2 antheridia each. Female inflorescence from about the middle of the thallus. Involucre deeply laciniate, the lacineae dentate; pseudoperianth cylindrical, 4-5-7 mm long, about 1 mm wide, narrowed below, the mouth dentate. Calyptra shorter than the pseudoperianth. Stalk of the sporangium up to 4 cm long. Sporangium ovate-oblong, 2-2.5 mm long, about 1 mm wide, reddish brown. Wall of sporangium of 3 or 4 layers of cells; epidermal cells large, with thickened radial walls; cells of inner layers much smaller than of the epidermis and their radial walls less thickened. Elaters attenuate, 8-10 μ wide, with 2 spirals, reddish brown; also a few shorter, wider, and loosely attached to the sporangial wall. Spores 33-43 μ, reddish brown, with short irregular ridges which sometimes form reticulations, margin in profile appearing to be coarsely papillose. Name from the country in which it was first found. Hibernia was the Latin name for Ireland.—In boggy places.

ILLUSTRATIONS: Hooker, Brit. Jung. pl. 78 and Suppl. pl. 4, 1816; Macvicar (374) 67, figs. 1-5; K. Mueller (409) 1: fig. 214. EXAMINATIONS: None.

TYPE LOCALITY: Ireland. RANGE: D. C. (364), Ont. (373), B. C. (508), Alaska (373); Eur. (409).

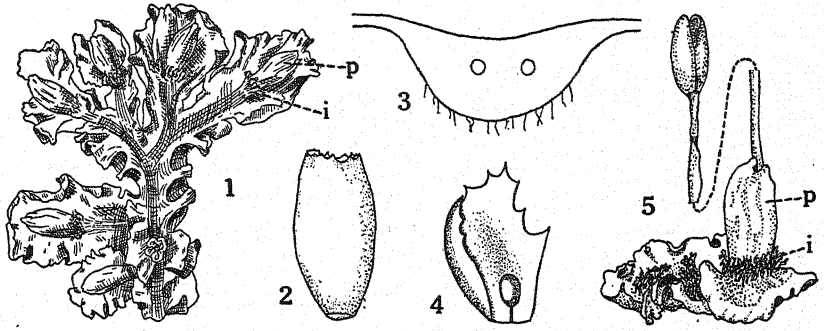
3. Moerckia flotoviana[160] (Nees) Schiffn., Oesterr. Bot. Zeitsch. 51:1901.

Cordaea flotoviana Nees, Diar. Bot. Ratisb. 2:401, 1833.
Diplolaena lyellii var. *flotoviana* Nees Naturg. Eur. Leberm. 3:344, 1838.
Blyttia lyelli var. *flotoviana* Nees, G. L. & N. Syn. Hep. 475, 1845.
Moerckia hibernica var. *wilsoniana* Gottsche, Gottsche & Rabenhorst Hep. Eur. Exsic., No. 121, 1860.
Pallavicinia flotovii Lindb. Musc. Scand. 10, 1879.

Thalli in patches, strongly odorous, bright green or yellowish green, dichotomously branched, 1-2.5 cm long, 3-5 mm wide, 15-22 cells thick in the middle. Vein concave on upper side, semiterete below, gradually passing into the lamina, with ovate scales on the dorsal side of the male plants only, usually with 2 lateral strands; cells of strands long, narrow, usually thick walled. Lamina 1 cell thick. Margin incurved, strongly undulate and usually crisped. Rhizoids white or pale yellow, on the under side of the vein. Thalli unisexual. Antheridia numerous, toward the tip, on the upper side of the vein; their scales ovate, irregularly dentate, with 1 antheridium each. Female involucre of bracts; these coherent at base, short, irregularly laciniate; pseudoperianth cylindrical, up to 5 mm long, 1 cell thick above and 3-4 below; mouth lobed, ciliate, frequently reddish brown. Calyptra 1 cell thick above and 4-5 below, shorter than the pseudoperianth. Seta 2-3 cm long. Sporangium oval-cylindric, 3 mm long, 1.3 mm wide, reddish brown; its wall of 5 layers of cells, with radial walls thickened and reddish. Epidermal cells of the sporangium large. Inner

[160]flō" tō vī ā' nă. The original spelling is flotoviana, instead of flotowiana. We return to it.

wall cells of the sporangium much smaller and more delicate than the outer. Elaters 300 μ long and 7 μ thick, occasionally shorter and wider, hardly contorted, reddish brown, attenuate, loosely attached to the wall of the sporangium; spirals 2-3. Spores 42-49 μ,[161] reddish brown, their ridges



Moerckia flotoviana. 1, Female plant, (*i*) involucre, (*p*) pseudoperianth, x 1.5. 2, Pseudoperianth, x 5.5. 3, Cross section of middle of thallus showing two strands, x about 15. 4, Male bract with one antheridium, x 24. 5, Female plant, (*i*) involucre, (*p*) pseudoperianth, x 4. (1, 5, after K. Mueller; 2, 4, after Pearson.)

frequently forming reticulations, the margin appearing to be papillose. Named in honor of Mr. Von Flotow, who first found it.—On moist sand, or wet soil.

ILLUSTRATIONS: Pearson (433) pl. 193, figs. 2-4, 9, 11-14; K. Mueller (409) 1: fig. 215; Macvicar (374) 68, figs. 1-4; Cavers, Interrelationships of Bryophyta 74, figs. 32-37, 1911. EXAMINATIONS:—*Alaska.* Seward (Rigg) 1913.

TYPE LOCALITY: "In Hohlwegen auf Raupachsberg bei Tiefhartmannsdorf" in Schleswig, Germany (Von Flotow) May 17, 1833. RANGE: Newfoundland (7), N. S. (53), Me. (363), N. H. (176), Vt. (171), Mass. (7), Conn. (185), Mich. (415), Wis. (98), Neb. (204), Alta. (51), Alaska (141), Wash. (81); Eur. (325).

PALLAVICINIA[162] S. F. Gray Nat. Arr. Brit. Pl. 1:775, 1821.

Dilaena Dum. Comm. Bot. 114, 1822.
Diplomitrion Corda, Opiz, Beitr. 1:653, 1829.
Diplolaena Dum. Syll. Jung. 82, pl. 2, fig. 21, 1831. Not of R.Br., 1814.
Gymnomitrion Hueben. Hep. Germ. 45, 1834. Not of Corda, Opiz, Beitr. 1:651, 1830.
Symphyogyna Mont. & Nees, Ann. Sci. Nat., Ser. 2, 5:66, 1836.
Blyttia Endl. Gen. Pl. 1339, 1839. Not of Arnott, 1838; not of Fries, 1839.
Hollia Endl. Gen. Pl., Suppl. 2:103, 1842. Not of Sieber, 1836.
Steetzia Lehm. Plantae Preissianae 2:129, 1846.
Systasis Griffith Notulae ad Plantas Asiaticus,—2. On the higher Cryptogamous plants. 1849. Calcutta.
Mittenia Gottsche, Triana et Planchon in Ann. Sci. Nat., Ser. 5, 1:77, 1864. Not of Lindb., 1863.
Pallavicinia Lindb., Not. Saellsk. Fennica 9:14, 1868.

Thalli prostrate, or with a creeping terete portion and a fan-shaped ascending one, very delicate, simple or rarely forked, sometimes with ven-

[161] K. Mueller, Rabenhorst's Krypt.-Fl. 6 (1):362, 1908, says they are 50-55 mu.
[162] păl" lă vĭ sĭ' nĭ ă. Gray spelled it *Pallavicinius.*

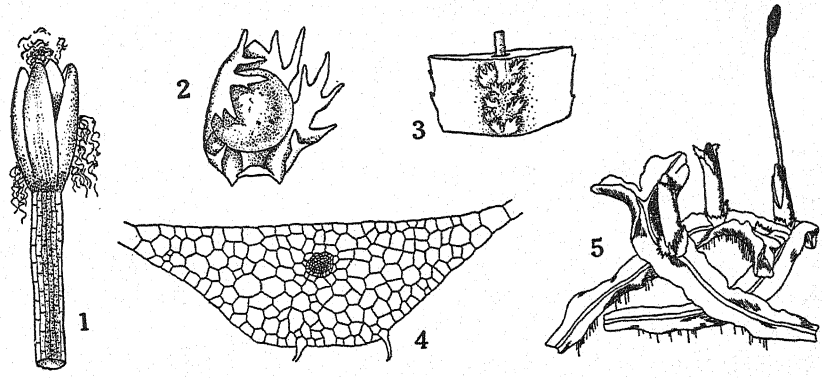
tral innovations. Vein with a central strand, convex on under side, grooved above; cells of the central strand narrow, 6 μ wide, very long; their walls thick, pitted. Lamina 1 cell thick. Margin entire to lobed, almost leaf-like. Ventral scales wanting. Thalli unisexual. Male plants little to distinctly different from the female; antheridia dorsal, on the vein, almost always in 2 rows, solitary, globose, shortly stalked, covered by scales; these scales variously dentate, arching toward the apex of the thallus. Archegonia dorsal, on the vein, in groups. Involucre of scales; the scales laciniate, coherent at base; pseudoperianth arising as a ring which becomes a tube inside the involucre. Calyptra fleshy at base. Sporangium oblong-cylindric, its wall of 2 layers of cells, both wall layers without semiannular thickenings; epidermal layer with thick brown walls; dehiscence by splitting into 2-4 valves, these usually coherent at tip. Elater bearers wanting; elaters with 2-3 spirals.—Named in honor of L. Pallavicini, an archbishop of Genoa, Italy.

1. **Pallavicinia**[163] **lyellii**[164] (Hook.) S. F. Gray Nat. Arr. Brit. Pl. 1:775, 1821.

Jungermannia lyellii Hook. Brit. Jung. pl. 77, 1816.
Jungermannia sinuata of Schweinitz Spec. Fl. Amer. Sept. Crypt. 19, 1821; not of Sw. Prodr. Fl. Ind. 145, 1797.
Jungermannia oblonga Schweinitz Spec. Fl. Amer. Sept. Crypt. 21, 1821.
Dilaena lyellii Dum. Comm. Bot. 114, 1822.
Diplolaena lyellii Dum. Syll. Jung. 82, pl. 2, fig. 21, 1831.
Gymnomitrion lyellii Hueben. Hep. Germ. 45, 1834.
Diplomitrion lyellii Corda, Sturm Fl. Germ. 2:19-20, 1835.
Blyttia lyellii G. L. & N. Syn. Hep. 475, 1846.
Steetzia lyellii Lehm. Plantae Preissianae 2:129, 1846.
Hollia lyellii of Sull. Musci Alleghaniensis 66, No. 281, 1846.
Symphyogyna oblonga G. L. & N. Syn. Hep. 483, 1846.
Symphyogyna schweinitzii Mont. & Nees, G. L. & N. Syn. Hep. 484, 1846.
Podomitrium majus Schiffner & Gottsche (According to Schiffn., Engler & Prantl Nat. Pfl.-Fam., Ed. 1, 1 (3) 1:54, 1893).

Thalli in patches, pale green, simple or innovating from the under side of the vein, rarely forked, 12-14 cells thick in the middle, suddenly grading into the lamina. Vein with a central strand of long narrow lignified cells, flat above, almost semi-cylindric beneath. Lamina 1 cell thick; cells 5-6-angled, elongate-rectangular at the margin, thin walled. Margin usually undulate, somewhat sinuate or shallowly lobed. Ventral scales wanting. Rhizoids rather numerous, on the under side of the vein, pale brown. Thalli unisexual. Male plants narrowly linear, much narrower than the female ones. Antheridia in one row, on each side of the vein; antheridial scales roundish-ovate, shortly laciniate, somewhat distant or imbricate. Archegonia dorsal along the vein; female inflorescence about the middle of the thallus length, involucre short, shortly and unequally

[163] As *Pallavicinius*.
[164] ly el' li i.



Pallavicinia lyellii. 1, Sporangium opening, x about 6. 2, Antheridial scale with one antheridium, x about 30. 3, Dorsal view of a part of a thallus bearing antheridial scales, x about 3. 4, Cross section of thallus, x 60. 5, Female plants, x about 1.3. (4, after K. Mueller; the others after Hooker.)

laciniate; pseudoperianth 5-7 mm long, 2 cells thick above and 2-3 below, cylindrical, ciliate at mouth. Calyptra equaling or slightly exceeding the pseudoperianth, 3-4 cells thick above and 4-6 below. Seta 3-3.5 cm long. Sporangium cylindrical, 4 mm long, reddish brown, its wall of 2 layers of cells when young but the inner resorbed at maturity; epidermis with thickened radial walls. Elaters hardly attenuate, reddish brown. Spores 21-24 μ, reddish brown, finely reticulate, the margin giving the impression of papillosity. Named in honor of Charles Lyell, who first found it.—In swamps, on wet banks of streams, often submerged.

ILLUSTRATIONS: Hooker, Brit. Jung. pl. 77, 1816; Ekart, Syn. Jung. Germ., pl. 10, fig. 87, 1832; Sullivant, Mosses of the U. S., pl. 6, 1856; Pearson (433) pl. 191; K. Mueller (409) 1: figs. 4, 212; Warnstorf (523) 106, fig. 1; Macvicar (374) 64, figs. 1-5. EXAMINATIONS:—*N. Y.* Risby Lake in Herkimer County (Haynes) 1906. —*N. C.* Winston-Salem (Schallert) 1923.—*Fla.* Sanford (Rapp) 1920; Pensacola (Young) 1933.—*Miss.* Biloxi (Clark & Frye Exsic. 4) 1931.

TYPE LOCALITY: Bartley Lodge, in the New Forest, Hampshire, England (Charles Lyell). RANGE: Newfoundland (212), Cape Breton Isl. (413), N. S. (53), N. B. (373), Me. (140), N. H. (203), Vt. (241), Mass. (232), R. I. (169), Conn. (467), N. Y. (336), Pa. (237), Ont. (373), Mich. (415), Ky. (218), Tenn. (464), Miss., Ala. (396), Fla. (337), Ga. (52), N. C. (12), Va. (226), W. Va. (468), Md. (444), D. C. (343); Bermuda (146); W. Indies (478); S. Amer. (491); Tahiti (406); N. Z. (212); P. I. (491); Java (491); Asia (387); Eur. (124); Africa (212).

BLASIA[165] L. Sp. Pl., Ed. 1, 1138, 1753.

Jungermannia Hook. Brit. Jung. pls. 82-84, 1816, in part.

Thalli prostrate, broadly ligulate, sparingly dichotomously branched. Vein wide, grading into the unistratose lobes; central strand unstated. Lamina a series of lobes, 1 cell thick. Margin deeply lobed. Ventral scales

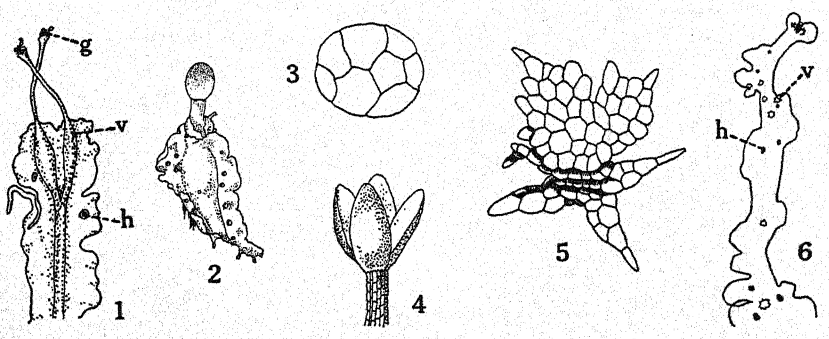
[165] blā' zĭ ă.

toward tip on each side of vein. Gemmae of 2 kinds, on upper surface; one kind in flask-shaped vessels, rounded or oval, compressed, long-stalked, about 60 μ; the other kind not in vessels, near the tip, scale-like, stellate. Thalli unisexual; sex organs on the dorsal surface. Male plants smaller; antheridia few, with short stalk, ellipsoid, immersed singly. Archegonia near the tip, in a group, at first naked, one when fertilized becoming immersed in a fusiform involucre with a constricted mammillate apex. Calyptra free, thin, membranous. Sporangium oval, with basal collar, dehiscing into 4 or rarely 5-6 valves to the collar; wall of sporangium 3-4 cells thick. Epidermal cells of the sporangium with nodulose radial walls. Inner cells of sporangium wall small, thin walled, without semiannular thickenings, soon disorganized. Elater bearers few, rudimentary, at base of sporangium; elaters with 2 spirals, the spirals often splitting. Spores 1-celled. Name in honor of Blazius Biagi, an Italian Benedictine monk of Florence, Italy, and an enthusiastic botanist.

1. Blasia pusilla[166] **L. Sp. Pl., Ed. 1, 1138, 1753.**

Jungermannia biloba Sw., Weber & Mohr. Ind. Musc. Crypt., 1803.
Jungermannia blasia Hook. Brit. Jung. pls. 82-84, 1816.
B. hookeri Corda, Sturm Fl. Germ. 2:49, pl. 13, 1830.
B. germanica Corda, Sturm Fl. Germ. 2:131, 1830.
B. funckii Corda, Sturm Fl. Germ. 2:83, fig. 23, 1830.
B. immersa Dum. Syll. Jung 81, pl. 2, fig. 20, 1831.
B. semilibera Dum. Syll. Jung, 82, 1831.

Thalli in patches or over areas, green or yellowish green, 1.5-2.5 cm long, 3-5 mm wide at tip ascending and often crisped. Vein wide, flat on under side, 8-12 cells thick in the middle. Margin lobed, ascending at tip,



Blasia pusilla. 1, Tip of thallus with (*v*) vessels containing (*g*) gemmae, (*h*) dark hollows containing a species of *Nostoc*, x 4. 2, Plant with sporangium, x about 3. 3, Gemma from within the vessel, x 225. 4, Sporangium open, x about 6. 5, Ventral scale from side not applied to thallus, x 110. 6, Ventral view of young shoot, (*v*) ventral scale, (*h*) dark dorsal hollows showing through the thallus, x 3.5. (1, 3, after Warnstorf; 2, 4, after Hooker; 5, 6, after K. Mueller.)

[166] pū' sil lā.

the marginal row of cells smaller than the others; lobes sometimes leaf-like, with commonly 2 black spots at the base of each; these spots auriculate outgrowths filled with *Nostoc* colonies and later imbedded in the thallus. Ventral scales ovate, dentate. Rhizoids numerous, from the under side of the vein, white. Seta up to 2 cm long. Spores 33-43 μ, yellowish brown, granulate. L. *pusilla,* small; it is not large for a thalloid liverwort. —On wet clayey or gravelly ground.

ILLUSTRATIONS: Hooker, Brit. Jung. pls. 82-84, 1816; Ekart, Syn. Jung. Germ. pl. 11, fig. 94, pl. 13, fig. 114, 1832; Sullivant, Mosses of the U. S. pl. 7, 1856; Pearson (433) pl. 196; Warnstorf (523) 125, fig. 1; K. Mueller (409) 1: figs. 23, 80, 221-223; Macvicar (374) 76, figs. 1-4. EXAMINATIONS:—*Conn.* West Goshen (Underwood 181) 1891.—*Wash.* Bothell (Frye) 1921; Eagle Gorge (Frye) 1924; Darrington (Frye) 1928; Scenic (Frye) 1934.—*Ore.* Bull Run, and Sandy Hook (Reed College collection) 1930.—*Ida.* Meadows (Frye) 1929.

TYPE LOCALITY: European. RANGE: Greenland (340), Cape Breton Isl. (413), Prince Edward Isl. (373), N. S. (212), N. B. (373), Me. (140), N. H. (359), Vt. (203), Mass. (5), R. I. (140), Conn. (467), N. Y. (498), Que. (178), Pa. (237), Ont. (373), Mich. (418), Wis. (98), Iowa (469), Alaska (135), B. C. (508), Ida. (81), Wash. (81), Ore. (239), Cal. (292), N. Mex. (194), Va. (212), Md. (444), D. C. (343); Australia (458); Asia (212); Eur. (389).

PETALOPHYLLUM[167] Gottsche, Lehm. Pugil. Pl. 8:29, 1844.

Codonia Dum. Comm. Bot. 111, 1822, in part.

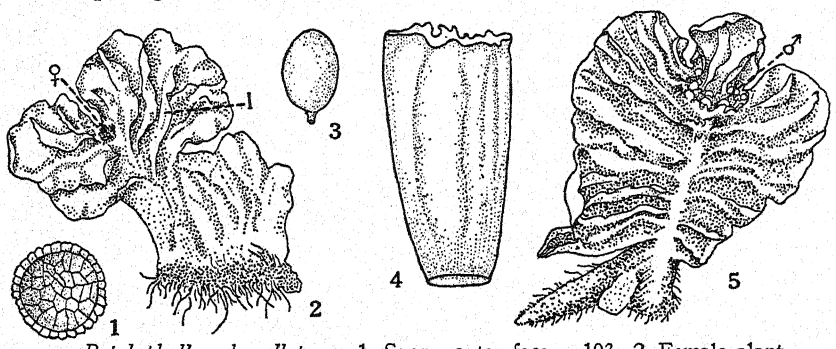
Plants small, tender, cylindrical and stalk-like at base, expanded and fan-like above, simple or forked, with erect dorsal lamellae on the lamina at an angle with the stem or vein. Plants unisexual. Antheridia scattered, on the dorsal surface, spherical, shortly stalked, covered by a conical or dome-like scale. Archegonia in groups, dorsal, on both sides of the vein. Involucre a crown of scales; pseudoperianth tubular, from within the involucre which is partly carried up by it. Calyptra large, free. Seta rather short. Sporangium spherical, rupturing irregularly; its walls of 3-4 layers of cells. Inner cells of sporangium wall with incomplete annular thickenings. Elaters long, more or less attenuate, with 2-3 spirals. Spores reticulate with high ridges.—Name from Gk. *petalon,* plate or lamella, and *phyllon,* leaf; in reference to the lamellae on the leaf-like lobes of the thallus.

1. **Petalophyllum lamellatum**[168] (Nees) Lindb. Manip. Musc. Sec. 390, 1874.

Diplolaena lyellii f. *lamellata* Nees Naturg. Eur. Leberm. 3:345. 1838.
Jungermannia ralfsii Wils. Engl. Bot. Suppl. pl. 2874, 1843.
P. ralfsii Gottsche, Lehm. Pugil. Pl. 8:30, 1844.
Codonia ralfsii Dum. Hep. Eur. 16, 1874.
Fossombronia corbulaeformis Trabut Atlas Fl. Algerie 7, 1886.

[167] pĕt à lō' phȳl lŭm.
[168] lăm" ĕl lā' tŭm.

Plants in patches, small, pale green, up to 1 cm long and to 7 mm wide with stalk-like subterranean base; upper part expanded, with lamina, prostrate, obcordate or reniform. Vein terete below, semiterete toward tip, prominent on under side, rather suddenly passing into the lamina. Rhizoids rather numerous, from the vein, white. Lamina 3-4 cells thick at base, grading into margin only 1 cell thick. Lamellae dorsal on lamina, extending obliquely forward from vein to near margin, sinuate, of 1 layer of cells, 15-20 cells high at highest part; their cells mostly hexagonal, thin walled, quite green. Ventral scales in 2 longitudinal rows at the apical re-



Petalophyllum lamellatum. 1, Spore, outer face, x 193. 2, Female plant, (*l*) lamella, x 8. 3, Antheridium, x 32. 4, Pseudoperianth, x 7. 5, Antheridial plant, x 8. (2, 5, after K. Mueller; the others after Pearson.)

gion, triangular, with a few long mucilage hairs. Pseudoperianth 3-4 mm long, broadly campanulate, most of it 1 cell thick; its mouth sinuate-lobed and dentate; the lobes incurved; the dentations distant, usually wide at base and spinose at tip, occasionally with a few short cilia among them. Calyptra 1-2 cells thick, but 3-4 cells thick at base, slightly shorter than the pseudoperianth, surrounded at base by withered archegonia. Seta white, pellucid, 8-15 mm long. Sporangium 2 mm thick, spherical, brownish black, of 3-4 layers of cells, quite greenish, opening by a slit and then irregularly. Epidermis of sporangium with thin hyaline walls. Inner layers of sporangium wall with reddish brown semiannular thickenings. Elaters 240-300 μ long, 12-14 μ wide, hardly attenuate; spirals 2, yellowish brown. Spores 42-48 μ, spherical, slightly compressed; meshes hexagonal, 10-14 μ wide, 4-5 across the face of the spore, bordered by a paler margin 6 μ wide with 13-15 projecting ridges. L. *lamellata,* bearing plates or scales; in reference to the dorsal lamellae on the thallus.—On sand dunes near pools on wet or rather dry sand.

ILLUSTRATIONS: Macvicar (374) 78, figs. 1-3; Pearson (433) pl. 190; K. Mueller (409) 1: fig. 224; Cavers, Interrelationships of Bryophyta, figs. 40-43, 1911. EXAMINATIONS: None.

TYPE LOCALITY: Aberffraw, Anglesea, Wales (J. Ralfs). RANGE: Tex. (190); Eur. (374); Africa (409).

FOSSOMBRONIA[169] Raddi, Mem. Soc. Ital. Sci. Modena 18:29, 1818.

Codonia Dum. Comm. Bot. 111, 1922.
Jungermannia L. Sp. Pl., Ed. 1, 1136, 1753.

Plants prostrate, firmly attached to the substratum by rhizoids but the apex ascending. Stems fragile, creeping, simple or dichotomously branched, flattened on upper side, strongly arched on under side; rhizoids long, mostly violet. Leaves in 2 rows, succubous, very obliquely inserted, decurrent on the ventral side, more or less quadrate, usually wider than long, 2 or more cells thick at base, otherwise 1 cell thick. Margins irregularly sinuate, usually lobed. Cells large, thin walled, quite green. Plants unisexual or bisexual; sex organs on the upper side of the stem near the insertion of the leaves. Antheridia orange yellow, naked or partly covered by bracts. Archegonia variously situated in relation to the antheridia, the fertilized one always near the tip of the stem. Pseudoperianth large, campanulate, narrow at base, often longitudinally plicate, surrounded by subulate scales, often cleft to the base on the side toward the tip of the stem; mouth wide, lobed. Calyptra tender, pyriform, thick at base. Seta short. Sporangium globose; dehiscence irregular or by 4 imperfect valves; wall of 2 layers of cells; the inner layer of complete or often incomplete semiannular thickenings. Elaters short, normally with 2 spirals. Spores large, rounded-tetrahedral, the convex face variously armed. Named in honor of Bittorio Fossombroni, an Italian statesman who aided botany.

A. Spores with a wide somewhat hyaline wing, with 8-12 ridges reaching the margin..... 6. *F. angulosa.*
AA. Spores without wing or with merely a very narrow opaque suggestion of it, at least usually with more ridges or teeth at the margin.
B. Elaters poorly developed or none, 28-58 μ long, with pale rings or with these united into 1 spiral..... 7. *F. cristula.*
BB. Elaters well developed, longer, at least in most with 2-3 spirals.
C. Outer face of spore with parallel or forked ridges which form no meshes except rarely 1-3.
D. Spores 50-60 μ in longest diameter; thalli unisexual..... 1. *F. texana.*
DD. Spores 36-50 μ in longest diameter; thalli bisexual.
E. Spores with 28-36 ridges projecting 0-2 μ at the circumference; the ridges rather narrow..... 2. *F. wondraczekii.*
EE. Spores with 20-30 or fewer ridges projecting 2-4 μ at the circumference; the ridges wide in some species.
F. Ridges of the outer face of the spore wide, as seen at margin 3-4 μ high and 16-24 in number..... 3. *F. pusilla.*
FF. Ridges of the outer face of the spore not wide, as seen at margin 2-3 μ high and 20-30 in number. 4. *F. longiseta.*
FFF. Ridges of the outer face of the spore narrow, as seen at margin 2 μ or less high and 16-20 in number..... 5. *F. braziliensis.*
CC. Outer face of spore reticulate.
G. Number of meshes on outer face of spore 0-13..... 5. *F. braziliensis.*

[169] fŏs sŏm brō′ nĭ ä.

GG. Number of meshes on outer face of spore 15-20 or more.
H. Inner wall of sporangium with mostly complete semiannular thickenings; outer face of spore with high ridges..... 8. *F. lamellata.*
HH. Inner wall of sporangium with mostly incomplete semiannular thickenings; outer face of spore with low ridges..... 9. *F. foveolata.*
CCC. Outer face of spore papillose, sometimes with faint ridges under the papillae, without meshes.
I. Papillae of the spores minute, close, short; spores very small..... 10. *F. macouni.*
II. Papillae of the spores 3-4 μ long; spines about 40 on the circumference of the spore; spores 30-40 μ..... 11. *F. hispidissima.*

1. **Fossombronia texana**[170] Lindb., Acta Soc. Fauna et Fl. Fennica 10:533, 1875.

F. cubana Aust., Bot. Gaz. 1:36, 1876.
F. pusilla var. *cubana* Gottsche, Wright's Hep. Cubenses Wrightianae Exsic. (After 1885.)

Plants large, gregarious, green. Stems up to 15 mm long, narrow, subterete, rigid and thick, projecting on under side. Leaves close together, large, broadly reinform from a narrow base, 4-5-lobed; lobes broadly triangular, acute to apiculate; the sinuses obtuse, plicate. Cells near leaf apex 37 x 37 μ, about the middle 40 x 60 μ, at base 50 x 92 μ. Plants unisexual. Pseudoperianth of equally long leaves, turbinate, stipitate, with 1 deep lateral rent; mouth variously incisely lobed; lobes repand, obtuse, recurved-crispate. Elaters 135-200 μ long. Spores 50-60 μ, with lamellae; these lamellae forked, low, undulate, rather prominent at the margin of the spore. Named from the state in which it was first found.—We do not know its habitat.

ILLUSTRATIONS: None. EXAMINATIONS: None.
TYPE LOCALITY: Texas. RANGE: Tex. (504); Cuba (514).

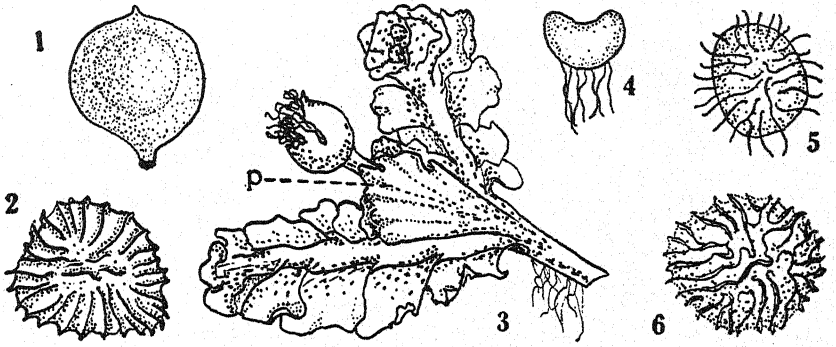
2. **Fossombronia wondraczekii**[171] (Corda) Dum. Rec. d'Obs. 11, 1835.

Jungermannia wondraczekii Corda, Sturm Deutschl. Fl. 2:130, 1830.
?Codonia wondraczeki Dum. Syll. Jung. 29, 1831.
Jungermannia pusilla var. *capitata* Nees Naturg. Eur. Leberm. 3:320, 1838.
F. cristata Lindb., Not. Saellsk. Soc. Fauna et Fl. Fennica Forhandl. 13:388, 1874.
F. cristata var. *wondraczekii* Lindb., Not. Saellsk. Soc. Fauna et Fl. Fennica 13: 1874.

Plants fairly robust, gregarious or in small patches, pale green, slightly odorous. Stems up to 10 cm long, nearly semicircular, flat above, about twice as wide as thick. Leaves closer toward tip; lower leaves distant to approximate, recurved, obcuneate, emarginate to shortly bilobed; upper leaves crowded, oblong-quadrate, sinuate-crispate, entire or variously

[170] těx ā' nă.
[171] wŏn drā tsē' kĭ I.

lobed, the lobes frequently acute. Plants bisexual. Antheridia near the archegonia. Seta 2-3 mm long. Inner layer of sporangium wall with a few mostly incomplete semiannular thickenings. Elaters about 120 μ long, 8-9 μ wide, with 2-3 spirals, yellowish brown. Spores roundish, 36-45 μ, red-



Fossombronia wondraczekii. 1, Calyptra, x 31. 2, Spore, outer face, x 600. 3, Plant, (*p*) pseudoperianth, x 15. 4, Cross section of stem, x 24. 5, Spore, x 204. 6, Spore, outer face, x about 470. (2, after Warnstorf; 3, after Schiffner; 6, after Corbiere; the others after Pearson.)

dish brown, densely lamellose; lamellae sinuous, nearly parallel, very rarely anastomosing, appearing in profile on the margin as 28-36 short and somewhat truncate spines. We do not know the origin of the name wondraczekii.—On bare moist soil in cultivated fields or little used paths, or at margins of ditches and ponds.

ILLUSTRATIONS: Schiffner (458) fig. 34; Warnstorf (523) 125, fig. 2e; Pearson (433) pl. 184; K. Mueller (409) 1: fig. 226 b; Macvicar (374) 82, figs. 1-2; Corbiere, Revue Bryol. 17: 1890, containing pl. 26, fig. 8, reprinted from Mem. Soc. Sci. Nat. Math. Cherbourg. EXAMINATIONS:—*N. Y.* New York (Britton) 1901.

TYPE LOCALITY: Germany. RANGE: N. B. (369), N. H. (169), Vt. (241), Mass. (141), Conn. (140), N. Y., Pa. (338), Ohio (511), Ind. (212), Md. (212), W. Va. (468), N. C. (43), Tenn. (464), Fla. (266); Asia (212); Eur. (120); Africa (409).

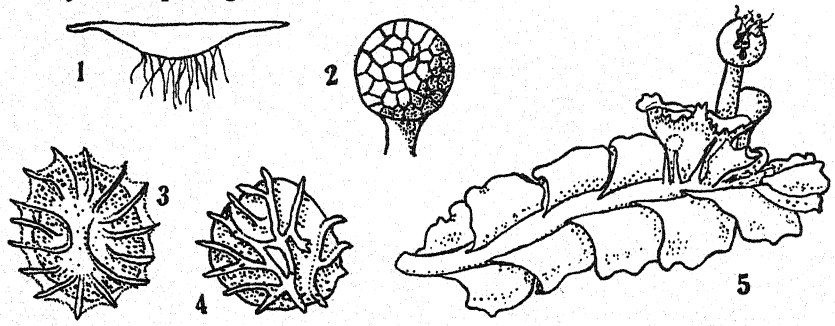
3. **Fossombronia pusilla**[172] (L). Dum. Rec. d'Obs. 11, 1835.

Jungermannia pusilla L. Sp. Pl., Ed. 1, 1136, 1753.
Maurocenius pusillus S. F. Gray Nat. Arr. Brit. Pl. 1:687, 1821.
Codonia pusilla Dum. Comm. Bot. 111, 1822, in part.
F. pumila[173] Dum. Rec. d'Obs. 11, 1835.

Plant in small pale green patches, odorous. Stems up to 13 mm long, simple or forked, strongly convex on the under side, flat or slightly convex on the upper side, about 3 times as wide as thick, rather suddenly grading into the leaves. Leaves succubous; lower leaves oblong-quadrate,

[172] pū' sĭl lă.
[173] Underwood (514) thinks this was merely a typographical error, and that *pusilla* was intended.

entire or emarginate, sinuous; upper leaves crowded, broadly reniform, crisped, lobed, the lobes obtuse or partly acute. Thalli bisexual; antheridia near the archegonia. Pseudoperianth 1.75 mm long, campanulate, the mouth crispate or sinuate-lobed, the lobes obtuse or sometimes acute. Inner layer of sporangium wall with many complete semiannular thickenings. Elaters 7-10 μ wide; spirals 2-3, pale yellow. Spores roundish, 36-45 μ in diameter, pale reddish brown; convex face with a few lamellae; these lamellae slightly sinuous, nearly parallel, thick, rarely slightly anastomosing in the center, appearing in profile at margins as 16-24 thick pointed spines. L. *pusilla,* small; it is a small species; but not the smallest. —On bare moist soil in cultivated fields, along ditches or trails, on banks.



Fossombronia pusilla. 1, Cross section of stem, outline, x 24. 2, Antheridium, x about 60. 3, Spore, outer face, x about 500. 4, Spore, outer face, x 400. 5, Plant, x about 6. (3, after Corbiere; the others after Pearson.)

ILLUSTRATIONS: Hooker, Brit. Jung. pl. 69,[174] 1816; Ekart, Syn. Jung. Germ. pl. 5, fig. 38,[174] 1832; Pearson (433) pl. 183; Warnstorf (523) 125, fig. 2f; K. Mueller (409) 1: fig. 226 a[175]; Macvicar (374) 81, figs. 1-5; Corbiere, Revue Bryol. 17; 1890, containing plate 26, fig. 7, reprinted from Mem. Soc. Sci. Nat. Math. Cherbourg; Meylan (386) figs. 55 a-c. EXAMINATIONS: None.

TYPE LOCALITY: European. RANGE:[176] Ont. (373), B. C. (373), Cal. (202); Eur. (409).

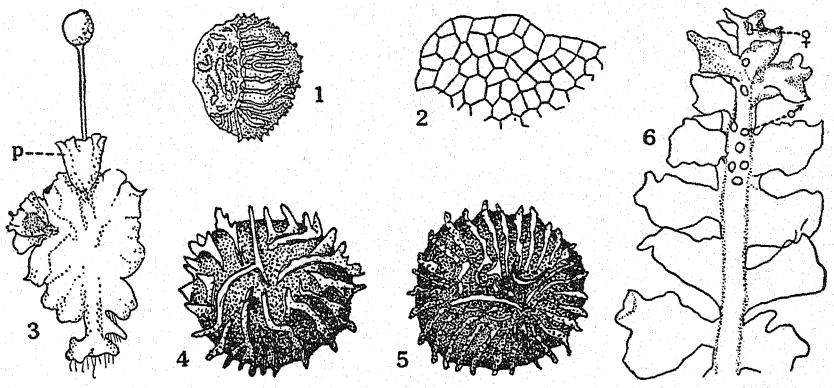
4. **Fossombronia longiseta**[177] Aust., Proc. Philadelphia Acad. Sci. 21 (1869):228, 1870.

Androcrypha longiseta Aust., Proc. Philadelphia Acad. Sci. 21 (1869):228, 1870.

Stems mostly 6-15 mm long and once dichotomous, rather stout, 15-20 cells thick, commonly somewhat tuberously thickened at apex and perennial through the resumption of apical growth on termination of the dry season. Rhizoids wine purple. Leaves 1.5-3 mm long, subquadrate, assurgent or nearly horizontal, more or less imbricate, irregularly lobed to toothed or subentire, often 2-5 cells thick toward the base. Leaf cells near

[174]Some doubt about these on account of the inaccuracy with which the spores are drawn.
[175]His figure 225 is drawn with the leaves incubous, although he describes them succubous.
[176]Evans (Proc. Cal. Acad. Sci., N. Ser., 13:121, 1923) expresses doubt whether *F. pusilla* occurs at all in N. America, because all the reported collections are based on incorrect determinations or on sterile specimens.
[177]lŏn gĭ sē′ tă.

margin 30-45 x 40-60 μ, near base 40-60 x 60-150 μ. Plants bisexual. Antheridia scattered singly or in groups over the stem, close to the leaf bases, sometimes very near the archegonia. Archegonia in small groups close to the leaf bases. Pseudoperianth usually large, 1.5-3 mm high, campanulate, open to the base on the side toward the stem tip, or connate there and



Fossombronia longiseta. 1, Ripe spore, x 373. 2, Part of leaf margin, x 93. 3, Plant, (*p*) pseudoperianth, x 3.3. 4, 5, Spores, outer face, x 407. 6, Plant, x 6.7. (1, 6, after Humphrey; 2, 3, after Sanborn; 4, 5, after Howe.)

forming a complete cup, usually with several small scales adnate to the outer surface; these scales mostly short but sometimes reaching nearly to the lobate-dentate mouth. Seta finally 8-18 mm long. Sporangium 1-2 mm thick; inner wall with mostly incomplete semiannular thickenings. Elaters 150-300 μ long, with 2 spirals. Spores 38-50 μ in longest diameter, distinctly compressed, yellowish brown, strongly and rather remotely cristate; crests high, projecting 2-3 μ at margin, 20-30 in number on the circumference, more or less obliquely ascending, slightly flexuous, thin, acute, usually undulate-serrulate, unequal in length, disappearing or sparingly confluent at the middle of the face, forming there very rarely 1-3 fully closed meshes. So named because its seta, although short, is comparatively long.—On moist banks and hillsides.

ILLUSTRATIONS: Humphrey, Ann. Bot. 20:83-108, pls. 5, 6, plus figs. 1-8, 1906; Howe,[178] Mem. Torr. Bot. Club 7: pl. 99, figs. 16-18, 1899; Sanborn, Univ. Oregon Publ. Pl. Biol., Ser. 1: pl. 1, figs. 8-9, 1929; Clark & Frye (81) 46, middle and left figs. EXAMINATIONS:—*Wash.* Kelso (Rakestraw) 1935.—*Ore.* Myrtle Creek (Frye) 1931; Kirby (Frye) 1931; Half Way (Frye) 1935.—*Cal.* Pasadena (Kingman 787) 1910; Napa (Carter 441) 1934; Yosemite Nat. Park (Carter 560) 1934.

TYPE LOCALITY: Ukiah, California (Bolander). RANGE: B. C. (508), Wash., Ore. (457), Cal. (309), Ariz. (184).

[178]Howe probably had a mixture of *F. longiseta* and *F. hispidissima.* Thus some of his figures are probably the latter. Likewise in Clark & Frye, Publ. Puget Sound Biol. Sta. 6:46, 1928, the figure of the spore on the right we now believe to be *F. hispidissima.*

5. **Fossombronia braziliensis**[179] Steph., Mem. Herb. Boissier 16:28, 1900; also Sp. Hep. 1:382, 1900.

F. salina Lindb., Acta Soc. Sci. Fennica 10:583, 1875, name only.
F. angulosa of Aust. Hep. Bor.-Amer. No. 119, 1873; not of Raddi, Mem. Soc. Ital. Sci. Modena 18:29, 1818.

Thalli scattered or caespitose, of medium size, dark green, paler or brownish with age. Stem dichotomous, 1 cm or more long, narrow, 300 μ wide, about 10 cells thick, prostrate, closely adhering to the substratum, upper surface plane or slightly convex, lower surface strongly convex or keeled. Rhizoids numerous, deep purple. Leaves distichous, more or less imbricate except on attenuate stems, variable in width, 1 cell thick at the very base, complanate, quadrate-oblong from a wide base, slightly decurrent. Margin entire except for apical lobing. Apex wide, indistinctly lobed and crispate. Lobes very variable, mostly rounded but sometimes apiculate or acute. Leaf cells very variable in size, averaging 28 x 37 μ along the margin, 30 x 60 μ in the middle, 70 μ at base. Thalli bisexual. Pseudoperianth turbinate, about 1.5 mm high, deeply cleft on one side, crispate at mouth, deeply and irregularly sinuate-lobed; the lobes rounded, entire. Seta short. Elaters very irregular, with 2-3 spirals. Spores 41-48 μ, brown, in some cases regularly reticulate with 11-12 polygonal meshes on the convex face; usually with irregularly forked lamellae without distinct meshes; lamellae low, thin, deeply pigmented in their lower part and in the region of anastomosis on the spore, often paler along the spore margin, projecting slightly on the spore margin as short and sometimes indistinct points. Named after the country in which it was first found.—On most ground.

ILLUSTRATIONS: Evans, Rhodora 3:8, fig. 1, 1901, spore. See also fig. 3, page 161 of this book. EXAMINATIONS:—*R. I.* Gloucester (Lorenz) 1922.—*Ga.* Thomasville (Brown) 1923.

TYPE LOCALITY: Apiahy, Brazil (Puiggari 82). RANGE: R. I. (169), Conn. (140), N. J. (137), Ark. (212), Okla. (463), Tex. (354), Fla. (266), Ga. (52), Tenn. (212), N. C. (43); W. Indies (212); Mex. (200), S. Amer. (200).

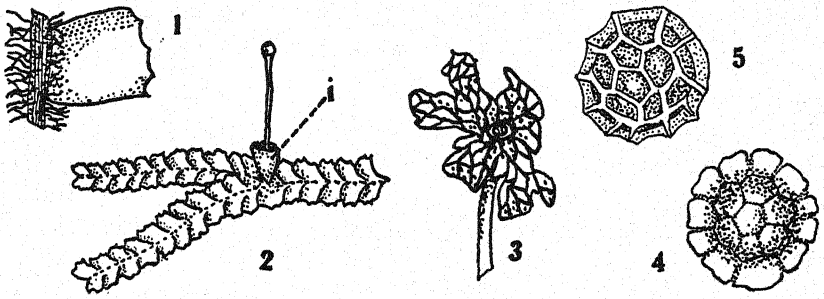
6. **Fossombronia angulosa**[180] (Dicks.) Raddi, Mem. Soc. Ital. Sci. Modena 18:29, 1818.

Jungermannia angulosa Dicks. Pl. Crypt. Fasc. 1:7, 1785.

Plants vigorous, in dense patches, pale green, crispate, becoming brownish yellow with age; patches large, dense, intricate. Stems up to 15-30 mm long, 6 mm wide, flat above, strongly convex below. Rhizoids numerous, long. Leaves grading from 3-4 cells thick at base to 1 cell thick farther toward middle, imbricate, ovate to oblong-quadrate or broadly cuneate, irregularly sinuate-lobed; lobes mostly small, frequently hardly

[179] brā zil" ĭ ĕn' sĭs.
[180] ăn gū lō' să.

apparent, obtuse or more rarely acute, sometimes spinose-ciliate. Margin occasionally with 1 or more teeth irregularly distributed. Cells of leaf base about 40 μ, much larger than those near apex. Plants unisexual. Male plant rather smaller than the female; antheridia numerous, very shortly stalked, partly covered by bracts and sometimes by a dorsal tooth; antheridial bracts lanceolate to cuneate, frequently dentate. Pseudoperianth turbinate; mouth sinuate and slightly lobed; the lobes sometimes



Fossombronia angulosa. 1, Leaf, ventral view, x about 6. 2, Portion of plant with female receptacle, (*i*) involucre, x 1. 3, Sporangium after dehiscence, x about 5. 4, 5, Spore, outer face, x about 400. (4, after Pearson; 5, after Corbiere; the others after Raddi.)

acute. Seta 6-7 mm long. Inner layer of sporangium wall with mostly complete semiannular thickenings. Elaters 220-250 μ long, 7-12 μ wide, with 2 or rarely 3 spirals. Spores 35-50 μ, reddish brown, regularly reticulate; their lamellae high, compressed; meshes only 4-5 across width of spore, 10-13 μ in diameter, distinctly hexagonal; margin of spore appearing as if surrounded with a wide transparent angulate wing, the angles 8-12 in number. Apparently so named on account of the angulate wing of the spore.—On moist soil of brackish meadows, or among rocks and on sides of ditches near the sea.

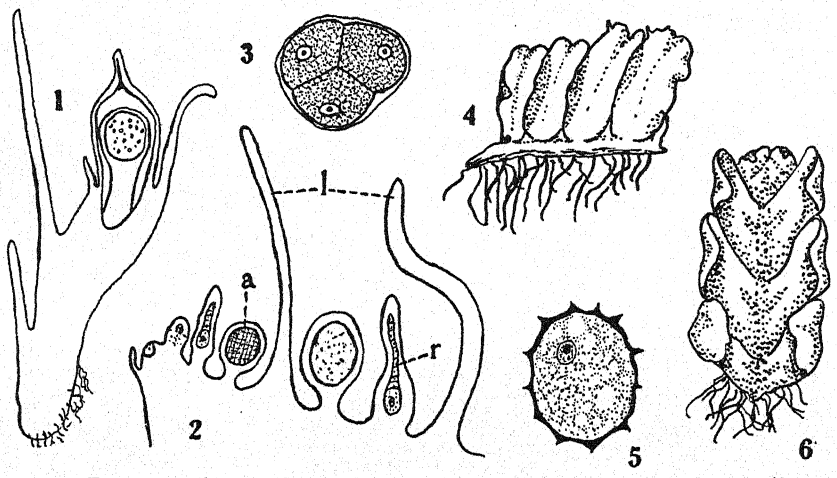
ILLUSTRATIONS: Lindberg, Manip. Musc. 383, pl. 1, fig. 3, 1874; Pearson (433) pl. 185; Macvicar (374) 88, figs. 1-2; Corbiere, Revue Bryol. 17: 1890, containing pl. 26, fig. 1, reprinted from Mem. Soc. Sci. Nat. Math. Cherbourg; Meylan (386) fig. 54A; Raddi, Mem. Soc. Ital. Sci. Modena 18: pl. 5, fig. 4, 1818. EXAMINATIONS: —*Fla.* Eustis (Underwood & Cook 118) 1891.

TYPE LOCALITY: Florence, Italy (Micheli). RANGE: Ont. (373), S. C. (396), Ala. (396); Eur. (101); Madeira (409); Canary Isl. (409); Azores (16); Africa (409).

Stephani (491) credits it to Texas and Cuba. But whether he had in mind *F. angulosa* or *F. braziliensis* is not certain.

7. **Fossombronia cristula**[181] Aust., Proc. Philadelphia Acad. Sci. 21 (1869):228, 1870.

Plants gregarious, small, delicate, pale green. Stems up to 5 mm long, on the under side strongly convex, subterete, thin, subsimple, branching under the inflorescence. Leaves contiguous, broadly ligulate, somewhat narrowed at base, entire or slightly sinuous above; upper leaves large, crispate, deeply 4-5-lobed; lobes rounded, widely recurved, the sinus prominent. Leaf cells 29 x 37 μ above, 37 x 65 μ about the middle, 55 x 110 μ at base. Pseudoperianth substipitate, turbinate, narrow, deeply cleft on



Fossombronia cristula. 1, Outline of sporophyte on part of plant, x 50. 2, Outline of part of median longitudinal section of plant, (*a*) antheridium, (*l*) leaves, (*r*) archegonium, x 68. 3, Tetrad of young spores, x 525. 4, Plant, side view, x about 8. 5, Spore, nearly mature, in optical section, x 525. 6, Plant, dorsal view, x about 8. (All after Haupt.)

one side; mouth quite wide, deeply 5-lobed; lobes roundish, recurved. Seta short. Sporangium immersed. Elaters few, inconspicuous, small, delicate, blunt, usually with 5-9 rings but these united to form a pale rudimentary spiral, 28-58 μ long, 6-18 μ wide. Spores 36-46 μ, pale brown, reticulate with lamellae; meshes numerous, mostly 8-10 μ wide, usually 6-7 across the face of the spore; lamellae about 2 μ high; margin as seen in profile prominently toothed but not bordered by a membrane. L. *cristula,* a small crest; from the ridged spores.—On moist sand on unfrequented paths.

ILLUSTRATIONS: Lindberg, Manip. Musc. 388, pl. 1, fig. 6, 1874; Haupt, Bot. Gaz. 69; pls. 16-19, 1920. EXAMINATIONS:—*Ohio.* Cleveland (Claassen) 1903; White's Gulch in Jackson County (Taylor) 1925.

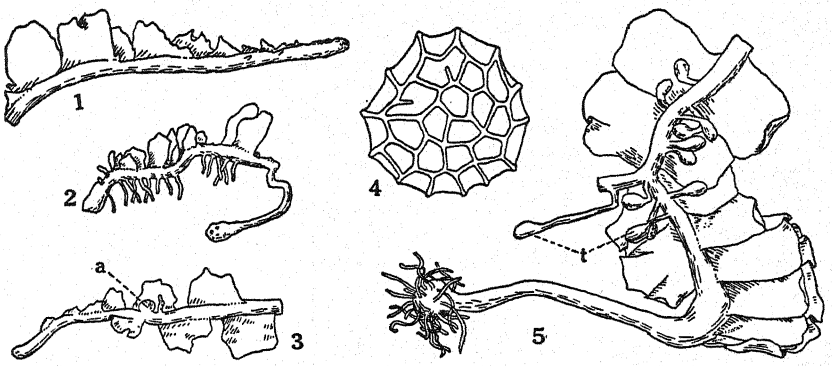
TYPE LOCALITY: Batsto, New Jersey (Austin) 1868. RANGE: Mass. (203), Conn. (203), N. J. (506), N. Y. (176), Ohio (97), Ind. (279), Cal. (514), Tex. (491), W. Va. (176); Eur. (458).

[181]kris' tū lă. Austin's name is *F. crispula,* apparently an error. The plant is not crispate while the spores are cristate.

8. **Fossombronia lamellata** [182] Steph., Hedwigia 33:9, 1894.

F. tuberifera Goebel Organographie der Pflanzen 292, 1898.

Thalli densely caespitose, small, light green. Stem up to 1 cm long, repeatedly dichotomous, prominent beneath; at base rhizomatous, subterranean, tuberous. Rhizoids purplish. Leaves suberect, subquadrate, with wide apex. Leaf cells about 35 μ, at base 35 x 102 μ. Margin angularly crispate, its cells thick walled. Perianth large, substipitate, campanulate,



Fossombronia lamellata. 1, Tip of sterile plant, x 9. 2, Small plant with tuber, x 9. 3, Tip of male plant, (*a*) antheridium, x 9. 4, Spore, x 1333. 5, Robust female plant, (*t*) tubers, x 5.3. (1-3, 5 after Evans.)

wide mouthed, with a few large remote recurved teeth, somewhat crispate. Seta comparatively long. Elaters 170 μ long, about 8 μ wide, with 2 spirals. Sporangium spherical. Inner wall of sporangium with semiannular thickenings; thickenings hyaline or at base of sporangium brownish. Spores brownish, 33-34 μ,[183] finely reticulate with lamellae; meshes about 20 on the convex face, 8-9 μ in diameter; lamellae forming occasional incomplete meshes, quite high, truncate, in marginal profile long and narrow.

ILLUSTRATIONS: Goebel, Organographie der Pflanzen, figs. 190-191, 1898; Evans, Bryologist 20: pl. 2, figs. 1-4, 1917. EXAMINATIONS:—*Fla.* Sanford (Rapp) 1924.

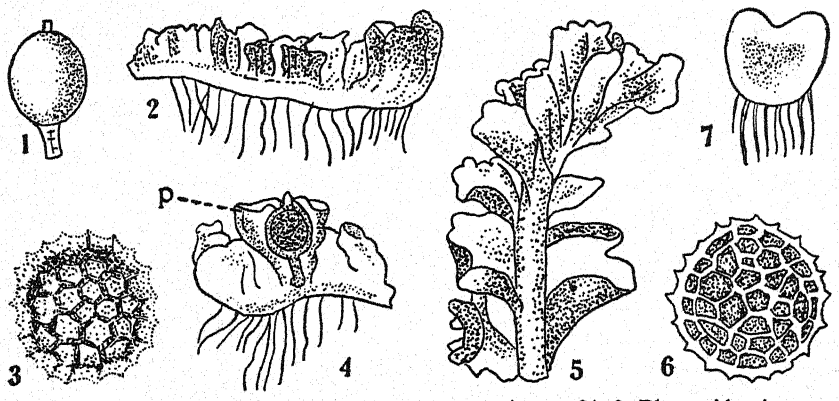
TYPE LOCALITY: Buenos Aires, Argentina (R. Hauthal). RANGE: Fla. (181); S. Amer. (181).

9. **Fossombronia foveolata**[184] Lindb., Soc. Fauna et Fl. Fennica, Dec. 6, 1873.

Codonia dumortieri Hueben. & Genth. Deutschl. Leberm. Exsic. No. 80, 1837, but the name only.
Fossombronia dumortieri Lindb., Not. Soc. Fauna et Fl. Fennica 13:417, 1874.
F. angulosa var. *dumortieri* Husnot Hep. Galliae 71, 1881.

[182] lăm″ ĕl lā′ tä.
[183] In Rapp's material mentioned below the spores were 15-17 mu, and the ridges on them not long and narrow in profile. Our figure of the spore is from one of these.
[184] fō″ vē ō lā′ tä.

Plants in patches, pale green, strongly odorous; patches rather extended, dense, intricate. Stems up to 2 cm long, furcately branched, greatly convex to nearly ovate on under side, slightly convex on upper side. Rhizoids numerous, long, violet, along the whole length of the stem. Leaves obliquely obcuneate, sinuate-lobed, bistratose at base, otherwise



Fossombronia foveolata. 1, Young sporangium, x 24. 2, Plant, side view x about 12. 3, Spore, outer face, x 400. 4, Tip of plant, with (*p*) perianth, x about 15. 5, Dorsal view of plant, x 15. 6, Spore, outer face, x 400. 7, Cross section of stem, x 24. (All after Pearson.)

unistratose. Leaf cells wide, polygonal, thin walled. Plants bisexual; antheridia either intermingled with the archegonia or separate on the same branch. Pseudoperianth 1.75 mm long, turbinate, mouth sinuate-lobed, occasionally with one or more teeth. Seta 2 mm long. Epidermal cells of the sporangium wall without localized thickenings. Inner layer of sporangium wall with thick and mostly incomplete semiannular thickenings along the radial wall. Elaters 120-135 μ long, 8-10 μ wide, with 2-3 spirals, pale yellowish. Spores spherical, 36-50 μ, brownish yellow, regularly reticulate; lamellae low; meshes 15-20 on the convex surface, 6-7 across width of spore, 5-6-angled, 7-9 μ in diameter; margin of spore without a membrane, appearing as if crenulate-dentate with 16-20 teeth. L. *foveolata,* minutely pitted; in reference to the reticulate spores.—On moors and damp sandy ground; in rock crevices.

ILLUSTRATIONS: Lindberg, Manip. Musc. 383, pl. 1, fig. 2, 1874; Pearson (433) pl. 186; K. Mueller (409) 1: fig. 24; Warnstorf (523) 125, figs. 2a, 2b. 2d; Macvicar (374) 86, figs. 1-2; Corbiere, Revue Bryol. 17:1890, containing pl. 26, fig. 2, reprinted from Mem. Soc. Sci. Nat. Math. Cherbourg; Meylan (386) fig. 54B. EXAMINATIONS:—*Ont.* Lake Nipissing (Britton 47) 1889, sterile.—*Wash.* Friday Harbor (Clark) 1923.

TYPE LOCALITY: Germany. RANGE: Cape Breton Isl. (413), N. S. (53), Me. (514), N. H. (140), Vt. (193), Mass. (235), R. I. (203), Conn. (169), N. Y. (59), Que. (178), Ont. (373), Mich. (483), Wis. (98), B. C. (212), Wash. (81), Tex. (514), La. (514), Ala. (396), N. C. (43), W. Va. (466), Del. (212), N. J. (212); Eur. (409).

10. Fossombronia macouni[185] Aust., Bot. Bull. (Bot. Gaz.) 1:36, 1876.

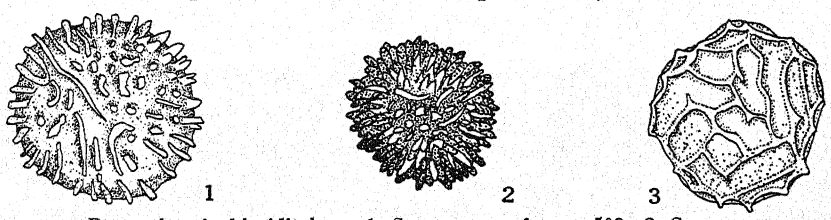
Stems very short, thickened. Leaves imbricate, strongly cristate-undulate, plicate, acutely incised-dentate. Pseudoperianth small, cup-shaped or funnel-shaped, crenate and somewhat undulate at margin. Sporangium large, exserted. Elaters rather thick, with 2 spirals. Spores very small, somewhat opaque, minutely and closely papillose. Named in honor of John Macoun, a Canadian botanist.—On earth and sand.

ILLUSTRATIONS: None. EXAMINATIONS: None.

TYPE LOCALITY: Methy Portage[186] (Portage la Lochs), Alberta, Canada. About lat. 56° 35′ N., long. 110° W. (Macoun) Sept. 15, 1875. RANGE: Known only from the type locality.

11. Fossombronia hispidissima[187] Steph. Sp. Hep. 1:389, 1900.

Plants gregarious, small, green. Stem up to 4 mm long, simple, quite convex on the under side, narrowly subcarinate, narrower than thick, cross section saccate in appearance. Leaves small, obcuneate, scarcely wider than long; base very narrow, with straight sides. Apex turned up or incurved-crispate. Cells near leaf tip 37 x 55 μ, about the middle



Fossombronia hispidissima. 1, Spore, outer face, x 508. 2, Spore, outer face, x 407. (After Howe.)

Fossombronia braziliensis. 3, Spore, outer face, x 477. (After Evans.)

37 x 80 μ, at base 37 x 92 μ. Pseudoperianth scarcely stipitate, pyriform from a narrow base, twice as long as wide, contracted under the mouth; mouth abruptly dilated, recurved, sinuate, subcrispate. Spores 30-40 μ, fuscous brown, papillose with long spines, also with some ridges but no indication of closed meshes, showing in profile about 40 projections 3-4 μ long. Name from the very hispid spores.—On wet soil.

ILLUSTRATIONS: Howe, Mem. Torr. Bot. Club 7: pl. 99, figs. 17, 20, 1899, as *F. longiseta*; Clark & Frye (81) 46, right figure, as *F. longiseta*. EXAMINATIONS: None.

TYPE LOCALITY: San Francisco, California (Bolander). RANGE: Cal. (202).

[185] mă kŏwn′ ĭ.

[186] The portage is between the northwest end of Methy Lake and the Clearwater River. There is some doubt whether the collection was made in what is now Alberta or in Saskatchewan. It was very near the boundary, which is lat. 110° W. Macoun gives it Athabasca, which is now Alberta.

[187] hĭs pĭd ĭs′ sĭ mă.

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